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TRANSACTIONS

OF THE

AMERICAN OTOLOGICAL SOCIETY,

FORTY-NINTH ANNUAL MEETING.

HOTEL RALEIGH,

WASHINGTON, D. C.

MAY 9 and 10, 1916.

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Names of deceased members while in membership in full face.

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*Associate.

American Otological Society.

The forty-ninth annual meeting was held at the Hotel Raleigh, Washington, D. C., May 9th, and 10th, 1916.

The following members and guests registered during the meeting:

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H. B. BLACKWELL
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T. LAURANCE SAUNDERS
GEO. H. POWERS
R. JOHNSON HELD
ANDREW TIMBERMANN

Guests.

DR. F. N. LAW
PROF. HALL
DR. GEORGE L. STREETER

Executive Session.

Tuesday Morning, May 9th.

The meeting was opened by Dr. Chas. W. Richardson, President, when the minutes of the Forty-eighth annual meeting were read and approved.

The President appointed on the Business Committee, Drs. Edward B. Dench, George E. Shambaugh and Francis R. Packard.

The report of the Secretary was read and approved, as was also the report of the Treasurer.

The President appointed as a Committee on Necrology, Dr. Robert Lewis, Dr. Norval H. Pierce and Dr. Stephen Lutz, to act on the deaths of Dr. Alfred M. Amadon, Dr. Edmund C. Rivers, Dr. H. N. Spencer and Dr. J. R. Fletcher.

Scientific Session.

Papers were read by the following: Drs. Amberg, Dench, Perkins, Bacon, Smith and Shapleigh.

Afternoon Session, 2 P. M.

Dr. George L. Streeter of Johns Hopkins gave a lantern demonstration on the "Development of the Perilymphatic Spaces in the Human Embyro."

Papers were also read by Drs. Blackwell, F. N. Law, T. L. Saunders, H. P. Mosher and O. A. M. McKimmie.

On motion, the thanks of the Society were extended to Dr. Streeter.

Wednesday Morning, May 10th, 9 A. M.

Scientific Session.

Papers were read by Pres. Hall of Gallaudet College, Drs. Goldstein, J. G. Wilson, G. E. Shambaugh, Geo. L. Richards and J. R. Page.

On motion, the thanks of the Society were extended to Pres. Hall for his paper and exhibition of cases.

Executive Session.

The Business Committee reported the nomination of officers for 1916–1917:

For President—Dr. Christian R. Holmes, Cincinnati, O.

For Vice President—Dr. Norval H. Pierce, Chicago, Ill.

For Secretary-Treasurer—Dr. John B. Rae, New York City.

For Committee on Membership—Dr. R. Lewis, to serve one year; Dr. James F. McKernon, to serve two years; Dr. Chas. W. Richardson, to serve three years.

For Committee on Publication—Dr. B. Alexander Randall, Dr. Arthur B. Duel, and the Secretary, *ex officio.*

On motion, these officers were duly elected.

The Committee on Membership recommended for membership in the Society: Dr. Francis P. Emerson, Boston, Mass.; Dr. L. W. Dean, Iowa City, Ia.; Dr. Isaac H. Jones, Philadelphia, Pa., and Dr. Albert F. Koetter, St. Louis, Mo. On motion, the report was accepted and these gentlemen declared duly elected to membership.

The committee further recommended that the applications of Dr. D. McPherson, Dr. W. L. Culbert and Dr. B. D. Parish be held over for one year in accordance with the By-Laws.

On motion, it was resolved that the Constitution and By-Laws be revised. The President appointed Drs. Dench, Rae and McKernon as a committee on revision to report at the next annual meeting. It was recommended to this committee that they consider the formation of a council consisting of a

President, Vice President, retiring President, Secretary, and three members to be elected.

On motion, it was ordered that all members presenting papers should send to the Secretary a synopsis, in time to be printed and distributed to the members before the annual meeting.

On motion, the Committee on Membership was instructed by the Society that the supreme test for the admission of candidates shall be their contributions to Otological literature.

On motion, the Secretary was instructed to request from Dr. Hardesty of New Orleans the demonstration of his model of the Membrana Tectoria at the next annual meeting. The Secretary was authorized to meet Dr. Hardesty's expenses.

Dr. Shambaugh suggested the advisability of symposial work with reference to the program. On motion, it was agreed this should be considered.

The President appointed as the Standing Committee: Dr. Edward B. Dench and Dr. B. Alexander Randall.

The Secretary presented excuses for absence from the following: Drs. Haskin, Harvey, McKernon, Birkett, Logan and Andrews. On motion, the excuses were accepted.

Committee on Necrology—Dr. Lewis reported on the deaths of Dr. Emil Gruening, Dr. John L. Adams and Dr. J. E. Sheppard. The report was accepted by a rising vote; it was ordered that the report be spread in full upon the minutes, and that copies be sent to the families of the deceased members.

DR. EMIL GRUENING was born in Hohensalza, Prussia, on October 2nd, 1842, and died at his residence in New York City on May 30th, 1914.

He emigrated to the United States in 1862 and was soon serving his adopted country in the ranks of the Federal Army.

He graduated from the College of Physicians and Surgeons in 1867. In 1871 he was appointed an Assistant Surgeon at the New York Opthalmic and Aural Institute, and a few years later was appointed Opthalmic and Aural Surgeon to the Mt. Sinai and German Hospitals. From 1877 to 1912 he served on the staff of the New York Eye and Ear Infirmary, when, having reached the age limit, he retired and was appointed a Consulting Surgeon, which position he held at the time of his death, as well as honorary positions in the other hospitals of which he had been so active a member.

Dr. Gruening was elected to membership in the American Otological Society in 1875, and served as its President in 1906 and 1907. He was a charter member of the New York Otological Society, and served as its President for two years.

Dr. Gruening was a man of broad learning and of a broad view of life, a man who had positive convictions, an honorable and a just man: a man who was held in great esteem by those who had the good fortune to know him.

In the reading or discussion of papers and in consultation, his views were given with a directness, a simplicity and a forcefulness that showed great power of discernment and of keen observation covering a period of many years of diligent work and research.

He did much to advance the Science of Otology, and will be greatly missed at our meetings, both as an exponent of our art and as a genial companion.

WHEREAS, the American Otological Society, at a meeting held in Washington, D. C., May 10th, 1916, record the above brief facts of Doctor Gruening's life and record with profound sorrow the death of one of their most learned and active members; and

WHEREAS, in the death of Doctor Gruening, Otology has lost one of the most resourceful exponents of its art; be it

RESOLVED, That the above report of the Committee on Necrology be entered upon the minutes of this meeting, and that a copy of the same be transmitted to the family of Doctor Gruening.

ROBERT LEWIS,
GORHAM BACON.

DR. JOHN LANSON ADAMS was born at Westport, Conn., August 9th, 1860, and died in New York City, September 25th, 1914. He received the degree of A. B. from Yale in 1883 and the degree of M. D. from the College of Physicians and Surgeons in 1886. He was an ex-Interne of New York Hospital and of the New York Eye and Ear Infirmary. His services at these institutions were followed by a period of two years' study of Otology, Rhinology and Opthalmology at the various clinics in Berlin, Vienna, Paris, London, Halle, etc.

He began the practice of these specialties in 1892. At the time of his death he was one of the Attending Surgeons in the Aural department and also a Director of the New York Eye and Ear Infirmary; Aural Surgeon to the Bloomingdale Clinic, West Side German Dispensary, Consulting Opthalmologist and Otologist to the Society of the Lying-In Hospital, the Manhattan State Hospital, etc.

Dr. Adams was a member of many societies, both social and medical, and was elected to the American Otological Society in 1893. He was a charter member of the New York Otological Society and served as its President for two years.

Dr. Adams was a man of most jovial disposition, a boon companion and a great raconteur. Dr. Adams was more at home in the operating arena than in the field of discussion. His cordial manner and open-heartedness will cause him to be missed from our meetings.

WHEREAS, the American Otological Society, at a meeting held in Washington, D. C., on May 10th, 1916, record the above brief facts of Doctor Adams' life, and record with profound sorrow the death of one of their members; and

WHEREAS, in the death of Doctor Adams, Otology has lost the services of an able practitioner of its art; be it

RESOLVED, That the above report of the Committee on Necrology be entered upon the minutes of this meeting and that a copy of the same be transmitted to the family of Doctor Adams.

ROBERT LEWIS,
GORHAM BACON.

DR. JOHN EVANS SHEPPARD was born in Greenwich, N. J., June 1st, 1859, and died at South Woodstock, Conn., on September 15th, 1915.

He received the degree of A. B. from Haverford College in 1879, and that of M. D. from the University of Pennsylvania in 1882.

During 1882 and 1883 he served on the House Staff of the Pennsylvania and University Hospitals, and was in general practice in Atlantic City from 1883 to 1888. He went to Europe in December, 1888, and studied Otology at the clinics in Berlin, Vienna, Munich and London. On his return he began the practice of Otology in the Borough of Brooklyn, New York City.

In 1890 he was appointed an Assistant Surgeon to the Brooklyn Eye and Ear Hospital, promoted to Surgeon the following year, resigned in 1901 and was appointed Consulting Surgeon, which position he held at the time of his death. He was Attending Otologist to the Church Infirmary and Dispensary, Professor of Otology at the Long Island College Hospital, Borough of Queens, New York City; also Consulting Otologist to the Brooklyn Hospital, the Jewish Hospital, the Methodist Episcopal Hospital, St. Catherine's Hospital, and Attending Aurist at the Long Island College Hospital, all in the Boroughs of Brooklyn and Queens, New York City.

Dr. Sheppard was elected to membership in the American Otological Society in 1894. He was a charter member of the New York Otological Society, and its President for two years; President of the Kings County Medical Society in 1904 and 1905.

Dr. Sheppard contributed to the Science of Otology many valuable monographs, embodying the observations of a trained mind backed up by keen penetration and judgment. In discussion and in consultation his opinions were always given in a clear, concise and convincing manner, which showed the result of long years of careful study and research.

Dr. Sheppard was a most humane, candid, dignified and modest gentleman: a loyal friend and a pleasant companion. He will be greatly missed at our meetings, both from a social and an intellectual standpoint.

WHEREAS, the American Otological Society, at a meeting held in Washington, D. C., May 10th, 1916, record the above brief facts of Doctor Sheppard's life and record with profound sorrow the death of one of their ablest members; and

WHEREAS, in the death of Doctor Sheppard, Otology has lost one of its earnest, faithful workers; be it

RESOLVED, That the above report of the Committee on Necrology be entered upon the minutes of this meeting, and that a copy of the same be transmitted to the family of Doctor Sheppard.

ROBERT LEWIS,
GORHAM BACON.

Cancer Committee—Dr. Chas. W. Richardson reported for the Cancer Committee. This report was accepted and the committee continued.

Report of the Committee on the Teaching of Oto-Laryngology was also received. On motion, this was accepted and the committee continued.

The resignation of Dr. S. C. Ayres of Cincinnati was presented by the Secretary and, on motion, was accepted.

The following nominations for membership were made:

Dr. R. T. Atkins, New York City. Proposed by Dr. Gorham Bacon; seconded by Dr. Fred Whiting.

Dr. S. L. Craig, New York City. Proposed by Dr. F. Whiting; seconded by Dr. Gorham Bacon.

Dr. G. H. Cocks, New York City. Proposed by Dr. Gorham Bacon; seconded by Dr. P. D. Kerrison.

Dr. H. H. Briggs, Ashville, N. C. Proposed by Dr. J. A. White; seconded by Dr. Geo. E. Shambaugh.

Dr. Don Campbell, Detroit, Mich. Proposed by Dr. Chas. E. Perkins; seconded by Dr. Emil Amberg.

Dr. Harold Wilson, Detroit, Mich. Proposed by Dr. Emil Amberg; seconded by Dr. S. MacCuen Smith.

Dr. S. J. Kopetzky, New York City. Proposed by Dr. Wendell C. Phillips; seconded by Dr. T. P. Berens.

Dr. S. McCullagh, New York City. Proposed by Dr. T. P. Berens; seconded by Dr. W. C. Phillips.

Dr. E. P. Fowler, New York City. Proposed by Dr. W. C. Phillips; seconded by Dr. J. J. Thomson.

Dr. J. E. Beck, Chicago, Ill. Proposed by Dr. G. E. Shambaugh; seconded by Dr. N. H. Pierce.

Dr. R. C. Lynch, New Orleans, La. Proposed by Dr. John B. Rae; seconded by Dr. S. MacCuen Smith.

The President appointed as delegates to the Council of the American College of Surgeons, Drs. Harris P. Mosher, Max A. Goldstein and Norval H. Pierce.

Wednesday Afternoon, May 10th.

Papers were read by Drs. N. H. Pierce, F. R. Packard, Chas. W. Richardson and S. F. Snow.

On motion of Dr. Mosher, the cordial thanks of the Society were extended to Dr. and Mrs. Richardson and Dr. and Mrs. Bryant for their kind hospitality to the members.

Dr. Richardson briefly expressed his thanks to the members of the Society for their support during his administration, and Dr. C. R. Holmes was then conducted to the chair.

Dr. Holmes thanked the members for the honor conferred upon him.

The Society then adjourned.

CONDUCTION APHASIA IN A CASE OF BRAIN ABSCESS.

By EMIL AMBERG, M. D., Detroit, Mich.

November 21, 1915, Dr. E. C. Hoff called me to see Mr. J. W., 37 years old. The patient appeared to be very sick, feverish. He had been ill for about ten days, with severe pain. He had had a middle ear suppuration for sixteen years in his left ear. After an effort, while cranking his automobile, he felt bad. Thinking of some complication of the chronic middle ear disease, I showed the patient a pencil. He could not name the pencil when he saw it, but he named it after I had asked him whether it was a pencil. Keys and watch were recognized but could not be named. I diagnosed an intracranial complication of a chronic middle ear suppuration. Dr. Carl D. Camp, of Ann Arbor, saw the patient, in consultation, the same night after his removal to Grace Hospital, and examined him from the neurologic standpoint. Dr. Camp diagnosed an abscess of the brain located in the temporal lobe and advised that the patient should have an eradication of the original focus in the middle ear, with an exposure of the dura if a sinus leading to it could be found; if no sinus was found, a second operation should be done directly over the supposed site of the abscess. Since the patient had no motor aphasia, and could evidently recognize objects seen, though he could not name them, it appeared that the lesion involved only the intracerebral tract leading from the center, for object recognition, in the occipital lobe, to the motor speech center. This tract is in the white matter of the temporal lobe and it was therefore supposed that the abscess was located there. The other neurologic findings were practically negative. A lumbar puncture showed about 500 lymphocytes to the c. mm. in the spinal fluid though there was no clinical evidence of the meningitis. This was evidently a case of the so-called "meningitis sympathica" such as described by I.

Strauss (Transactions of the American Neurological Society for 1915.) (Dr. Camp).

The next morning, November 22nd, I performed a radical mastoid operation and removed masses of cholesteatomatous material. Pus led the way upward and backward, and a small opening of the skull above and somewhat behind the external ear canal exposed a fresh pinkish-colored pachymeningitis.

Patient was not benefitted by the operation. November 26, Dr. Canfield, of Ann Arbor, made an extensive opening adjacent to the upper little opening for about a length of 1½ inches backward, and of a width of about ¾ to 1 inch, exposing also the lateral sinus. Introduction of the brain knife through the before-mentioned area of pachymeningitis, to a depth of 2 c. m. did not reveal anything. The patient did not improve.

November 30, four days later, while doing his dressing in bed, I incised vertically the dura, which did not pulsate, about half an inch behind the before-mentioned spot of pachymeningitis, and introduced Jackson's brain searcher, following Dr. Harold Wilson's suggestion, to whom I intended to demonstrate the procedure, forward, upward and inward, and liberated about six drachms of pus. No pulsation; colon bacillus.

December 1, I introduced the brain searcher backward and liberated about three drachms of pus. No pulsation of brain. Not much improvement.

December 4, I introduced the brain searcher deeper and more forward and liberated over one ounce of pus. Brain pulsated, patient better.

December 7, more pus was liberated by me. Good pusation. The brain searcher was directed to a point about ½ to ¾ inch above eye-brow, in the middle of the forehead, and introduced to a depth of about 1¾ to 2 inches. About one ounce of foul smelling pus, with gas was evacuated. In my estimation the cavity was about 2½ inches long toward the glabella, 1½ inches high, and about ½ inch deep. This estimate may be faulty. Upon Dr. Hoff's suggestion, a rubber drainage tube was introduced. Discharge

all day. The drainage tube was introduced daily to a depth first of about 4 c. m. and gradually shortened.

About the 15th of January the brain wound had closed entirely. The general clinical symptoms, pathological findings and details of technic are not the subject of my paper. I intend to dwell only on the speech disturbances.

As mentioned before, a pencil, keys and a watch could not be named when I saw the patient first. Dr. Canfield of Ann Arbor, examined also the tactile sense. A coin was felt in the right hand as such. Other articles were not named. Dr. Canfield wrote me as follows:

First: "He had distinctly a tactico-optical aphasia. He could not name objects until immediately after they were named for him. He held this memory picture for from 30 seconds to a minute and a half but never longer, as far as my observation went, until that day I saw him at home. That is, while in the hospital he could not name a watch but called it a letterhead, invariably. If he was told it was a watch, he could name it and held memory for from 30 seconds to a minute and a half. You will remember that my diagnosis was a subcortical brain abscess and that we stated before the operation that, due to the fact that the collection of pus was subcortical, it would probably not be evacuated at the first operation but would be reached three or four days later because by that time the incision made in the brain at the time of my operation would have permitted the pus to pass along the path of lower resistance to the surface at which it would be possible to evacuate.

This has been my experience with other subcortical abscesses and points toward the proper method of treatment of deep brain abscesses. The patient showed no clinical evidences of meningitis other than a leucocytosis of the spinal fluid."

December 23, when the patient saw a watch he could not name it but spelled: w-a-t-c-h. When shown a pencil he said: "I cannot see it," probably meaning that he could not see the word pencil.

January 3rd, 1915, when shown a collar button he said: "Collar, necktie pin." He tried hard to say the word but could not do it until it was pronounced for him. When shown keys he said "k-y-s" and then "keys." When shown a nail file he said "man" (probably wanting to say "manicure") "that's funny," "manicure instrument, fingernail business." When I rubbed my card with the nail file he said "would not call it sawing." He now knows and pronounces well, pieces of money, also pencil, watch.

January 4, 1916. When shown the nail file of yesterday he said: "This is a manicuring instrument." When I asked him, "Is it a saw," he said, "No, it is a file."

January 5th. He could remember his special nurse's name for the first time, although she had been with him for six weeks. He said that he could not remember the nurse's name before even for a short time and that he repeated it before "a hundred times," then when it "slipped for a moment it was gone."

The nurse made some additional report. "Patient had forgotten whether sugar or salt was used with meat. When he wanted sugar he would say vinegar. About two weeks after the pus was found he would look at illustrated magazines and was able to recognize the different buildings and localities but could not read the printing underneath. About four days later he began to slowly spell words. Several days later he could read slowly. Four weeks after the pus was found he wrote his first letter. Only two words were misspelled. He said it was easier for him to write than to speak. Names seemed to be the most difficult. Before the pus was released he suffered severe pain, but he seems to have forgotten it." (Patient told me that about two or three weeks were almost entirely blank to him, although he remembered that he commented on the nice suit of one of the consultants).

"In the sixth week, at times, when he could not say the word, he could spell it. He went to the club, he knew the members there but could not call them by name. After he had left the club he could name them."

January 11. Patient said that he could write better than read. Said he could write fast but when he read he could not "say" the word he read,—sometimes some simple word. If he wanted e. g., to pronounce a word like "closed," he might say "c-l-o-s-e-d." "I can write that word." Before Christmas he said, he made only two mistakes in writing a letter. He said he knew that he made the mistakes but he could not figure out how the words should be spelled.

On January 17, in my office, patient wanted to tell me the size of the boats going to Puerto Rico, where he is in business, and he said that they were not so big as the boats going to Europe, about 8000, but could not remember "tons." He knows that his memory is not right yet. He walks every day and has a good appetite.

January 18. When asked about the size of the boats to Puerto Rico, he remarked, without being assisted, "8000 what you call it pounds?—no, what is the name of it—8000 pounds? no—tons."

January 22. A nurse, a patient of mine, was present in the office. She wore a velvet coat. He could not say "velvet," but he knew it was not silk or linen. A few minutes afterwards he had forgotten the name "velvet." A few minutes later he had forgotten it again; then he said he would remember it because he spelled it for himself. The fourth time, after quite a few minutes had elapsed, he remembered the word. Patient claimed that he never was familiar with velvet. He said that he remembered a telephone number for an hour that morning.

January 24. When asked for name of material of cloth of a patient, he stated correctly "velvet." He said he had written it down.

January 29. Said that about one week ago he played billiards (3 balls) and played it just as good as ever. Made once 14 in succession, average 3½ in succession.

February 3. He said that when he wrote to his wife in the hospital before Christmas, when he was writing with regular speed, words came to him more easily. When he tried to read what he wrote he could not tell whether it was right

or wrong. He could not connect his thoughts, that he had written correctly, with only two words wrong, that he wrote "phonograph" instead of "telephone." The second mistake he did not remember. He had to spell names to himself before he could pronounce them. He saw the name written in his mind.

Three weeks after he entered the hospital he could not pronounce the name of his old friend the family physician, Dr. R., unless he put the whole thing together—"Doc. R.," the name he used for years. He did not call his sister-in-law by her right name, (Susie) but called her Margaret (this is the name of his other sister-in-law, who was not here at all, but in Albany). They are said not to look alike. He did not know that he had made a mistake. After sister-in-law Susie went to the hospital to see him, he did not mix up names any longer.

After Christmas, I may add, I asked him when I changed his dressing, to name rubber gloves. He said, "rubber—rubber—I got some for Christmas—gloves."

November 29, 1915. Dr. C. C. McClelland reports. Examination of fundus with "H. & C." drops, pupils dilated fully and equally in usual time. Left eye details of fundus easily seen. Nerve head indistinct on nasal side, more clearly defined on temporal side. Right fundus about same as left.

November 20. Total leucocytes 20,900; Poly. 88.4%; blood culture negative.

November 23. White 14,932; Poly. 79%.

November 25. Total white 14,100; Poly. 79%.

November 26. Total white 13,240; Poly. 75%.

November 27. Total white 10,666; Poly. 71.6%.

November 29. Total white 11,000; Poly. 71.1%.

December 7. Total whites 12,000; Poly. 68.5%.

December 23. Cells in spinal fluid 172 per c. mm. No organisms.

April 4, 1916, the patient wrote me from Puerto Rico that he felt very well but that he tired quickly and that he sometimes had headache and dull pain in the head when he worked too much.

Blau (Encyklopaedie des Ohrenheilkunde 1900) says: That in otitic intracranial complications an abscess in the temporal lobe touches the sensory speech cortex by a distant effect (Fernwirkung), that it never destroys it and that probably never are all paths emanating from the cortex interrupted. The amnestic aphasia occurs most frequently in otitic brain affections. In single instances the word treasure is reduced to one or a few words (Monophasia), sometimes the faculty to read (Alexia) or to write (Agraphia) is more or less diminished if the abscess extends more posteriorly into the occipital lobe, a speech disturbance may occur which has been named "optical aphasia" by Freund and Oppenheim. It occurs by interruption of the association fibres between sound, memory and optical centres. The word-memory cannot be used any longer for speech by way of vision. If the connection with the sound-memory centre is brought about in another way, e. g., through the hearing organ, tactile sense, etc., the patient immediately finds the word for the object presented.

Oppenheim (1908, page 84) says, under "optic aphasia (Freund)" that objects are seen and recognized, but cannot be named, although the patient can speak and can find the word if the stimulus is awakened from another sphere of the senses. Example: He cannot name a watch, but he knows that it is a watch. Another calls a handkerchief which is shown to him a sponge, a rag—he knows that it is to use to clean the nose, he recognizes the object—he finds the word handkerchief when one puts it into his hand. The patient, therefore, is not able to make use of the optic memory-pictures for the language. This occurs mostly if the focuses are located on the border of the left occipital and temporal lobes and if they are so extensive that they interrupt the paths leading from both occipital lobes to the sound-memory centre. Mostly there exists alexia hemianopsia and frequently sensory aphasia. In one case word deafness was not present, also hemiopia is not necessarily present.

Preysing in Wulstein and Wilms "Textbook of Surgery" (page 195), says: "Local brain symptoms may be very plain

in otitic abscesses of the brain and make the diagnosis absolutely certain, but they may also be absent when very large abscesses are present. In abscesses of the left temporal lobe (in right-handed patients), we may find the symptom of amnetic aphasia. The patient may say for what purpose an object may be used, but he cannot find the name of the object. If the name of the object is pronounced for him, the patient repeats it."

Our patient, also, mixed up the words teeth and feet. According to Bing (Basel), this is a paraphasia. It occurs because we unconsciously make the word first sound internally by aid of the sound-memory centre (sensory speech centre), and then we pronounce it. If this centre does not work, wrong words may easily be produced.

Oppenheim (page 838) mentions the following symptoms under conduction-aphasia:

Understanding for speech Understanding for writing	present.
Voluntary speech Loud reading	present, but paraphasia.
Voluntary writing Writing upon dictation	present, but paragraphia.

Repeating of speech, more or less disturbed.

The defects in our patient fit somewhat in this category.

Koerner, "Otitic Diseases of the Brain, etc." in 1896 mentions that Schmiegerlow found in 54 cases of left otitic temporal lobe abscess 23 cases (=42%) exhibiting speech disturbances. He says the patients frequently use wrong words or call objects by false names (conduction aphasia) and that the patients do not find the names of the objects although they know what they are used for.

He mentions that Oppenheim and Pick have shown the optic aphasia. The patients see an object but cannot name it. The location of the disturbance is assumed to be in the posterior part of the second and third temporal lobe.

The disappearance of speech disturbances after evacuation of the abscess may be explained by the fact that the brain

surrounding the abscess is only temporarily diseased, either by increased pressure or edema. Koerner quotes v. Bergmann as follows: "The abscess increases the pressure in the cranium by increased pressure of the cerebrospinal fluid everywhere where this fluid lies in the arachnoideal sinus and the lymph-spaces of the brain. The pressure is also transmitted, unevenly, through the "hard soft" mass of the brain so that the more adjacent parts are affected the most. To this must be added the influence of the inflammatory edema which surrounds the abscess."

In otitic temporal lobe abscesses, says Koerner, there is frequently a lesion of the capsula interna mostly with paresis of the contralateral extremities, rarely contralateral paralysis. There are contralateral spasms and convulsions and tonic spasms on the other side. Besides, there are pareses, rarely spasms of the facial on the other side, sometimes contralateral hemianesthesia and homongen bilateral hemiopia.

Dr. Goerdt—Dortmund (Archiv fuer Ohren Nasen und Kehlkopfheilkunde, Vol. 98, August, 1915, page 104, etc.) describing a cured case of abscess of the temporal lobe with rupture into the lateral ventricle, says:

"Patient, female, 16 years old, suffered from middle ear suppuration on both sides since she was three years old. On the right side a radical operation was performed and the dura extensively exposed. After a few days, severe headache appeared again, pulse 52. Babinski positive on right side. Slight paresis of right arm and left leg. Amnestic aphasia. When a handkerchief is shown to the patient she does not find the name, but says that one uses it to clean the nose. There is slight tactile optical aphasia. A pencil placed into the left hand is called a 'little stick' whereas it is immediately recognized as a pencil in the right hand. A key felt by the left hand is not recognized, but is recognized by the aid of the right hand. A temporal lobe abscess on the left side was evacuated, yielding about 6-8 tablespoonfuls of pus besides two tablespoonfuls of cerebrospinal fluid."

Discussion.

Dr. Wells P. Eagleton, Newark, N. J., congratulated Dr. Amberg upon having a case in which there was recovery, but he took exception to certain statements in the paper. The essayist had quoted Dr. Canfield as advocating making an exposure and letting the pus take its course. Objection to this procedure was urged on the basis that subcortical brain abscesses never travel outward, but always travel inward, from nutritional reasons, toward the lateral ventricle. Post-mortem reports showed that a large number of such abscesses rupture in the lateral ventricle, for this reason. Knowing the location of a temporosphenoidal abscess, the proper course was to evacuate at once. It was possible, by the proper procedure, invariably to locate the abscess at the primary operation. It was, in his opinion, a fundamental mistake to make repeated explorations, as had been done in the case reported. A brain abscess should be evacuated thoroughly at the primary operation, every part of the wall of the abscess should be explored, a small drain may then be carried in, the wound practically closed, except for the small wick or drain, and the brain left alone.

Dr. Ewing W. Day, Pittsburg, Pa., had always followed the procedure advocated by Dr. Amberg, allowing a brain abscess to work outward. He had always believed that the removal of the sustaining wall of the skull with incisions of the dura provided a line of least resistance for the working outward of the pus, and lessened the danger of general infection and death.

Dr. E. B. Dench, New York City, agreed with Dr. Day. He did not consider, as suggested by Dr. Eagleton, that postmortem findings could be compared with the findings at operation. If the pus worked inward, it was because the line of least resistance was inward. By the removal of a part of the calvarium this line of least resistance was directed outward, and the pus then worked outward. This

was done for the double purpose of sealing up the dura and for relieving the outward pressure so that the inward pressure would force the pus nearer to the surface, thus facilitating evacuation.

Dr. George L. Richards, Fall River, Mass., referred to a case which he reported last year before the Society, in which the pus worked toward the ventricle, as suggested by Dr. Eagleton. This patient had optic neuritis of two or three dioptres.

Dr. Gorham Bacon, New York City, asked if there were any epileptiform manifestations after operation. He had had a case in which Dr. Starr predicted that there would be such attacks, and in which there were twenty-six or more after operation.

Dr. S. MacCuen Smith, Philadelphia, Pa., recalled a case similar to that cited by Dr. Bacon. Pus was evacuated from three different parts of the brain. The patient was still living, but had had epileptiform attacks extending over several years. The attacks had gradually subsided but had not ceased entirely. In another case, with optical aphasia, after the exhibition of various objects had failed to elicit a correct response, the display of a silver dollar was successful.

Dr. Amberg, in closing the discussion, said he must have misunderstood Dr. Eagleton last year when he said it was not advisable to open a brain abscess through the primary focus, because if opened there meningitis might ensue. He understood him at that time to advocate opening from above in a clean field. It might perhaps be advisable to follow the procedure of J. W. Murphy ,of Cincinnati, who if he remembered correctly, opened in one case one inch above and slightly in front of the meatus. He was inclined to consider surgery of brain abscess more or less of a gamble. Specimens studied postmortem usually gave a picture of a very irregular cavity.

It is impossible to tell whether an injection fluid for diagnostic purposes might not push the infection inwardly and form a new abscess. The danger of spreading the infection was always to be thought of in brain abscess. The presence of epileptiform attacks in these cases probably depends upon the location of the diseased area. The patient had none. The same applied to convulsions. So far as the aphasia was concerned, it would give only some idea of the location of the abscess, as it also depended upon the extent to which the surrounding tissue, according to von Bergman, had become edematous and upon the amount of pressure exercised upon the tracts involved. In general at the present time a case of cured brain abscess was more or less of a curiosity. The patient reported is not yet considered cured, because not a sufficient time has elapsed since the time of operation.

ACUTE MASTOIDITIS WITH UNUSUAL SYMPTOMS INDICATIVE OF INTRACRANIAL INVOLVEMENT. OPERATION. RECOVERY.

By EDWARD BRADFORD DENCH, M. D., New York, N. Y.

The patient was a young woman, age 17, who, following an attack of grippe, suffered from an acute otitis. She was seen by me on the eighth day after the inception of the middle-ear inflammation. During this period, two myringotomies had been performed. The night before I saw the patient, the temperature had risen to over 103°, and on the day that I saw her the temperature was 104°. She presented the usual signs of a narrowed fundus of the external auditory meatus and a bulging drum membrane. The mastoid was exquisitely tender throughout. An immediate operation was performed. The mastoid cells were found to be filled with blood and some free pus. The mastoiditis was clearly of the hemorrhagic variety. A complete operation was done, and the dura in the middle fossa was exposed over an area about three-quarters of an inch square. The dura appeared healthy. The zygomatic cells were exceedingly well developed, and these were thoroughly eradicated. The upper portion of the wound was sutured, and drained from its lower angle by means of two gauze drains. Owing to the high temperature, an immediate blood culture was made, and this was repeated on the second day. Both blood cultures were negative. The patient's temperature, at the time of operation, was 104°, and it fell with regular remission—until about the fourth day after operation it became normal and so remained.

The patient left the hospital about ten days after the operation. She seemed very weak, and although she complained of no pain at this time she did not seem to be doing well. Two weeks and a half after the operation, the patient began to have headaches. The pain was located chiefly in

the frontal and temporal regions. This pain was so severe as to keep her awake. Three weeks after the operation the patient came to the office with a temperature of 104° and a pulse of 142. She was immediately sent to the hospital, and a blood culture taken. This was negative. The temperature gradually fell to normal, and the wound—which throughout had been doing poorly—seemed to improve.

The patient left the hospital again in about a week, and at this time had very little pain. One month and three days after the primary operation, the headache returned and there appeared a paralysis of the external rectus oculi of the corresponding side. The patient at this time was suffering from severe frontal headache, was excessively tender to pressure over the first branch of the trigeminal nerve, was pale and anemic, and was exceedingly hysterical and lachrymose. Careful tests showed no ataxia, no nystagmus, fair hearing in the operated ear, a normal temperature and a normal pulse. Although the site of operation was the left side, there was no aphasia. The patient was given bromides, internally, to relieve the extreme nervousness from which she was suffering. These symptoms continued, with increasing severity, for about twelve days. During this time the abductor paralysis became absolute. The temperature during this period remained normal and the pulse normal. The patient's general condition, however, steadily deteriorated. She became more and more nervous, the pain in the head increased, she lost flesh, and her progress was in every way unsatisfactory.

Six weeks after the first operation, the patient again entered the hospital—on account of the severe headache and her general nervous symptoms. At this time, the abducens paralysis was complete, but aside from this there was absolutely no evidence of any intracranial involvement. The hearing was fair on the affected side, there was no spontaneous nystagmus, and no evidence of any labyrinthine involvement. There was no aphasia, and an ophthalmoscopic examination showed both optic discs perfectly normal. Spinal fluid negative. The patient was seen in consultation

with Dr. Pearce Bailey, who agreed with me that there were no signs of any intracerebral involvement. While the case resembled those cases first reported by Gradenigo, I felt certain that there was no deeper focus of suppuration owing to the thoroughness of the original operation. I could only explain the pain by assuming that there had been an inflammatory process extending along the dura from the area of original exposure inward to the Gasserian ganglion, and that this inflammatory process accounted for the pain. Such an inflammatory process would naturally account for the abducens paralysis.

One month and two weeks after the first operation, I reopened the wound and extended the incision forward to a point one inch behind the margin of the orbit. The dura of the middle cranial fossa was exposed over an area about three inches in diameter. This area included the area of dura exposure at the primary operation and extended both anteriorly and posteriorly to this; in other words, the dura of the entire middle fossa was exposed. The dura was carefully elevated by means of a flat spatula, and the entire floor of the middle fossa explored, including, of course, the roof of the petrous pyramid. Absolutely no pus was found. The dura at the site of original exposure was somewhat thickened, but otherwise the dura appeared to be perfectly normal. Firm dural adhesions at the lower extremity of the first area of dural exposure were broken down by means of the blunt dissector. A folded rubber tissue drain was introduced to the very apex of the petrous pyramid. The anterior portion of the incision was closed and the mastoid wound was left wide open. I wish to emphasize here that absolutely no pus was found in either the mastoid wound or the middle cranial fossa. In other words, the first operation had been absolutely thorough, and this portion of the wound required no revision. The day after the operation, the patient's temperature rose to 105°. She complained of no pain, however, and was perfectly rational.

From this time on, she began to improve and ultimately made a complete recovery. On the second or third day after

the operation, she developed beginning choked discs in both eyes. This swelling of the optic papillae gradually increased and was more marked upon the operated side. The rubber tissue drain was removed from the middle fossa, and immediately the optic neuritis began to disappear.

The subsequent history of the patient is one of uninterrupted recovery. The wound healed perfectly, the hearing on the affected side was excellent, and the abducens paralysis had practically disappeared when the patient was last seen. Subsequent reports of the patient show that she is in a practically normal condition.

Perhaps the most comprehensive article on this class of cases was written by Dr. Charles E. Perkins, and published in the Annals of Otology for September, 1910. The case which I have reported, however, presents some new points, and is particularly interesting from the fact that at the time of the second operation no extradural area of suppuration was found, neither was any deep focus of pus found within the bone, as so frequently occurs in these cases. In a number of cases reported, the mastoid cells were found to extend into the apex of the petrous bone, and an evacuation of pus in this region was followed by immediate relief. In the present case, the pain seemed to be due simply to a low grade of inflammation of the dura extending inward and involving the Gasserian ganglion. The sixth nerve was also involved as it crosses the apex of the petrous pyramid. The stripping up of the dura from the underlying bone seemed to cause a resolution of the inflammatory process with a subsidence of all the symptoms. The case is particularly interesting as bearing upon trigeminal neuralgia in cases of middle-ear suppuration. The case certainly demonstrates that severe intracranial symptoms may occur without any demonstrable focus of pus in cases of this character.

Discussion.

Dr. Wendell C. Phillips, New York City, had recently had an experience quite similar to that reported by Dr. Dench. A young woman, 23 years of age, who had been struggling

for an education and who had exposed herself in many ways to exhaustion, had an attack of grippe. Almost immediately afterward she had an attack of middle ear suppuration. The drum membrane had been incised many times before he saw the patient, and, she had been told by otologists whom she consulted, that she had mastoid tenderness. He did a simple mastoid operation, in the course of which he encountered an extensive area of necrosed bone. The streptococcus was the prevailing microorganism. The patient did not do well any time after the operation. Her temperature remained up, going as high as 103, and one day to 104 degrees. He had repeated blood cultures made, because he thought it more than likely that he was dealing with an atypical case of lateral sinus thrombosis. He was still of that opinion. She went on for about three weeks with considerable exhaustion, headache, one or two chills, and paralysis of the external rectus of the eye on the affected side. Nothing kept him from opening the lateral sinus except that the blood cultures did not show bacteremia. After a long period of "watchful waiting" she began to improve, the paralysis subsided, and after about three months she had recovered without operation.

Dr. Stephen H. Lutz, Brooklyn, N. Y., recalled a case of paralysis of the external rectus on the side of the mastoid operation. The paralysis was the only post-operative symptom, and occurred just one week after operation. There was no rise of temperature, very little pain, and negative blood culture. The patient insisted on leaving the hospital the day after the onset of the paralysis. In two weeks the paralysis had entirely subsided, and the patient was perfectly well.

Dr. Charles E. Perkins, New York City, said Dr. Dench's case illustrated in marked manner the vulnerability of the sixth nerve as it passes along the base of the skull, and showed the way in which the nerve may be attacked as it passes along the canal which Gradenigo called Dorello's

canal. Any pressure from the swelling of the contiguous dura naturally affected the nerve. This was the first case which had come to his notice in which the affection of the nerve was post-operative, and due to an extension of the thickening of the dura in the middle fossa, although in the 96 cases which he had collected there were several in which the nerve lesion was due to thickening which had extended from an extra dural abscess in the middle fossa.

Dr. George E. Shambaugh, Chicago, Ill., cited a case of paralysis of the external rectus following a mastoid operation. The case was complicated by a very profuse purulent discharge, which apparently came from an infection of tympanic and tubal cells, as the region in the floor of the tympanum and around the mouth of the Eustachian tube showed the most distinct evidence of bone involvement. An effort to remove the diseased bone in this region, working as cautiously as possible brought on, however, a bleeding from the internal carotid, which was immediately controlled by a firm tampon. The paralysis of the external rectus began to develop the second day after the operation and within twenty-four hours was apparently complete. It was not until about a month later that a distinct improvement in the paralysis became evident. The case is still under observation.

Dr. Dench, in closing the discussion, said the case cited by Dr. Phillips was not exactly like his own. In his there was an elevation of temperature on only three occasions, with a return to normal, whereas in Dr. Phillips' case there were daily elevations and remissions of temperature. He did not know whether it was a case of "watchful waiting" or being "too proud to fight." In Dr. Lutz's case inasmuch as there was no pain he would not have operated the second time. He had operated on account of the pain. There was no pus in his case. Dr. Shambaugh's case was interesting. He thought the abducens paralysis might be caused by the plugging of the external carotid as it comes around the bend.

He asked Dr. Shambaugh if the bleeding could have been venous, to which the latter replied in the negative, saying it was too high up for the bulb.

INDICATIONS FOR THE LABYRINTH OPERATION WITH REPORT OF THREE CASES OF MENINGITIS.

By CHARLES E. PERKINS, M. D., New York, N. Y.

There seems to be practical agreement among aural surgeons in regard to the treatment of certain forms of labyrinth disease. This is the case in circumscribed purulent labyrinthitis where nature has been able to limit the process to one part of the labyrinth. If encountered during operation, these fistulae are to be let alone. To use the probe upon them with the view of gaining some information or the curet with the object of aiding in their cure, only too often results in the process becoming general, with the most disastrous consequences. Many cases might be detailed in which the use of the probe or curet, under these circumstances, has resulted in general purulent labyrinthitis, meningitis and death. If a fistula is suspected in an active labyrinth, a radical or mastoid operation may be performed; but manipulation at the site of the osseous defect in the labyrinthe capsule is very dangerous.

Then again, in a serous labyrinthitis no one would think of opening the labyrinth. It is unfortunate that at times the diagnosis between purulent and serous labyrinthitis becomes impossible. Nevertheless, anyone who operated upon a labyrinth, the seat of a serous process, would do so upon the supposition that the disease was purulent in nature, and that even if this was not the case, since the diagnosis was impossible, it would be safer to drain the labyrinth.

As to the indications for operation in the manifest stage of purulent labyrinthitis, surgeons seem to be divided into two groups. The one would open and drain every such labyrinth, while the other, regarding themselves as conservative, operate only when meningitis occurs or seems imminent. The former, no doubt, perform operations on a considerable number of patients who would recover without interference.

while the latter allow many patients to die who would have had a very good chance to live had they been operated on earlier. The following is a brief report of three cases, in which the latter plan was adopted. They were under the writer's care, in Dr. Dench's service at St. Luke's Hospital and at the New York Eye and Ear Infirmary.

Case I—J. S., male, age 28, had chronic suppuration in the right ear for which a radical operation with primary graft was performed on December 22nd, 1914. He apparently made a good recovery leaving the hospital at the end of two weeks. The graft took throughout the major part of the cavity, but granulations formed in the region of the fenestrae. One week later, that is, three weeks after operation the patient complained of vertigo, nausea and had nystagmus to the opposite side. Tests made at this time apparently showed presence of irritability of the labyrinth. Three days later he complained of pain in the side of the neck which later became very severe and radiated to the head. Patient was admitted to the hospital and lumbar puncture performed. The spinal fluid contained 276 leucocytes per cubic millimeter, lymphocytes 89 per cent., polymorphonuclears 11 per cent. Globulins present. Culture of this fluid for 36 hours gave a few colonies of gram positive cocci in chains and pairs. Examination, made three hours after the lumbar puncture, showed the hearing in the right ear O. with absence of caloric reaction. Rotation to right nystagmus to left 15 seconds, rotation to left nystamus to right 7 seconds. Labyrinth removed after the Neumann method. Cerebrospinal fluid drained from the internal auditory meatus for 36 hours; but the operation seemed to have but slight, if any, beneficial effect upon the meningitis, and patient died on January 28, five weeks after the radical operation, the meningitis having lasted one week. Spinal fluid on the day of death contained leucocytes 9000 with a poly-percentage of 93, Butyricacid test positive.

Case II—M. B., male, 11 years old. Chronic suppuration in the right ear for eight years. There was a polypus and granulations in the tympanum with a posterior defect in the

membrana tympani. Radical operation on July 19th, 1915, by Dr. Bowers. Primary graft did not take and convalescense was complicated by rise of temperature at end of first week, due to infection of the radical cavity, which cleared up on irrigations with a solution of iodine. Discharged August 2nd in good condition. Readmitted August 11th. Patient had vertigo and vomiting for two or three days accompanied during the last day or so with headache and fever. There was a well marked nystagmus to the left, that is to the unoperated side. Hearing on the right ear 0. No reaction with hot or cold water irrigation. Turning to right nystagmus to the left increased for about 15 seconds. Turning to left no nystagmus to the right. Spinal fluid leucocytes 720, poly-percentage of 73. Globulins positive. Culture negative. Labyrinth operation with free exposure of dura in the middle and posterior fossa performed on the day of admission. Abscess containing caseous material found upon incising the dura in the internal auditory meatus, culture from which was negative. August 14, spinal fluid leucocytes 1,700, poly. 98. Globulins ++. Slight reduction of copper by Fehling's test. Culture negative. This fluid injected into a guinea pig produced no apparent results. The fluid from several other spinal punctures was negative upon culture. Exploration of the temporosphenoidal lobe and cerebellum gave negative results. Patient died on the 16th of August, four weeks after the radical operation, one week after the onset of meningitis.

Case III—H. C., male, age 20, had a simple mastoid operation on the right side June 21st, 1915. Wound healed; but discharge continued free and possessed odor, notwithstanding irrigations and other local treatment. In December, six months later, otoscopic examination showed drum membrane absent, internal tympanic wall dermatized except in the region of the oval and round windows where granulations were present. A sinus discharging pus extended up beneath the posterior fold.

Radical operation with primary graft was performed at 3 p. m. on December 12, 1915. No dura or sinus exposure.

About 24 hours later the patient became dizzy and developed nystagmus toward the side of the unoperated ear. Temperature 101.5°, but no headache.

Twenty hours later, that is 44 hours after the operation, the patient seemed better; vertigo less, in fact nearly absent; nystagmus unimproved, temperature 100.5°. As the patient had had a very slight headache, a lumbar puncture was made, obtaining fluid under some pressure, which contained 145 leucocytes to the cubic millimeter with a poly-percentage of 70; Globulins present. Reduced copper by Fehling's test. Culture of this fluid was negative. The patient was totally deaf in the right ear and irrigation with hot or cold water was without effect upon the eyes. A labyrinth operation was performed at once, that is, about 48 hours after the radical. Free flow of cerebrospinal fluid from the internal auditory meatus. The sinus was accidentally wounded by the assistant while sponging, probably by a chip of bone. In addition to removing the promintory, the modiolus was taken away with the curet. There was no facial paralysis.

The flow of cerebrospinal fluid continued for six days, being quite copious at first. During this time it was impossible to obtain more than a few drops of fluid by spinal puncture, so no leucocyte count was possible; but culture was negative. The temperature varied between 102° and 99° during the first week, then continued practically normal. There was headache, stiffness of the neck and a positive Kernig. The nystagmus diminished slowly; but there was no vertigo complained of except during the first 24 hours after the onset of the labyrinthitis.

Lumbar puncture on the 6th day after the labyrinth operation gave fluid with a cell count of 26 and a trace of globulins probably due to admixture with blood. Culture and complement fixation test of this fluid were both negative.

On April 9th, more than 3½ months after operation, rotation to right nystagmus to left 17 seconds, rotation to left nystagmus to right 7 seconds; in other words, compensation in the sense in which the word is used below had not become established.

The tympanum dermatized over and the posterior wound filled with granulations then became covered with epithelium without the production of a permanent posterior opening, healing being complete in about four months, the patient being in a fine physical condition.

As to the nature of the meningeal process in this patient it seems very probable that it was an early stage of a purulent inflammation which was cut short by the prompt performance of the labyrinth operation. Still as the patient recovered and no bacteria were demonstrated in the spinal fluid by culture the possibility of its being of a serous nature must be conceded. Case II above reported died and cultures of the fluid obtained at four separate lumbar punctures were negative. Was it therefore of a serous nature? It was suggested by the pathologist that perhaps the fluid contained an anaerobic germ. As no more fluid was available, the patient having died, this matter could not be investigated.

Yansen (cited by Ruttin-Diseases of the Labyrinth) reports a case of serous meningitis cured by a labyrinth operation.

It seems as though this case would teach us that the spinal fluid gives evidences of meningitis before there are any clinical manifestations of the disease. This being so if one determines to treat a patient who has the manifest form of a purulent labyrinthitis expectantly, lumbar puncture made at regular and frequent intervals will afford the surgeon the earliest possible evidence of the onset of meningeal inflammation and enable him to remove the labyrinth with a prospect of success, when if he waits for fever or headache, the process will then be in too advanced a stage to expect much from a labyrinth operation.

It is the writer's belief, however, that every labyrinth the seat of a diffuse suppurative inflammation should be drained by opening the vestibule and removing the promontory, and this at the earliest moment after the diagnosis has been established. This operation naturally is not sufficiently extensive when evidence, clinical or cytological, is present that the meninges are involved. In this case the Neumann operation

or some modification of it which drains the subdural space at the internal auditory meatus and exposes, and incises if necessary, the dura in the middle and posterior fossae, should be performed.

As to the latent form of diffuse suppurative labyrinthitis there are three types of case:

I. First those in which the middle ear process is healed and requires no treatment. These patients are usually doing very well and as there is no hope of regaining any function with or without operation there seems no reason to interfere as the danger of meningeal inflammation is as a rule passed.

II. In the second class the latent purulent labyrinthitis is associated with a purulent otitis media. When this is the case operative interference with the object of relieving the middle ear process becomes a graver procedure, on account of the traumatism having a tendency to break down the barriers which nature has interposed between the suppurative process in the labyrinth and the meninges. It is, therefore, safer to open and drain the labyrinth at the time the radical operation is performed. The writer believes this drainage is sufficient; but some surgeons claim that the danger of intracranial infection is still further minimized by removing the posterior surface of the petrous pyramid to the internal auditory meatus, then opening and draining the subdural space in this location.

In one type of case an exception may be made to this rule. If the disease in the labyrinth is a healed process danger of infection of the meninges may be regarded as practically absent. This occurs when the labyrinth spaces become filled with fibrous tissue and new bone. Ruttin has shown with a fair degree of certainty that this has taken place in patients who show "compensation" on the rotation test. Thus with one labyrinth destroyed as shown by total deafness and negative caloric reaction, if upon rotation with head erect the after nystagmus in either direction is about equal and in the neighborhood of 10 or 12 seconds, "compensation" has taken place and it may be assumed that the condition in the labyrinth is a healed process. In this

event, one would, until further evidence is forthcoming, be justified in performing a radical operation without at the same time interfering with the labyrinth.

III. The third class are those cases in which there is necrosis of the labyrinth capsule. When this occurs, either in the form of a fistula leading into a dead labyrinth or with the presence of a sequestrum, it is one's plain duty to remove the dead bone and afford adequate drainage.

Discussion.

Dr. E. B. Dench, New York City, thought the case which recovered particularly interesting, because it was one in which there was a question about waiting. He had seen the patient with Dr. Perkins and thought the operation should be performed at once. This was done, and he believed that saved the patient's life. A high cell count in the cerebrospinal fluid, in his opinion, indicated a beginning meningitis. He did not agree with Dr. Perkins that it is dangerous to curet about a labyrinthine fistula. He had had cases in which he had curetted the semicircular canal, merely enlarging the fistula, not breaking up any adhesions. These cases had all done well. He had also seen cases in which, at the time of the radical operation, the oval window had been opened and the stapes had been removed. In none of these cases had he taken out the labyrinth, in none had suppurative labyrinthitis followed, and the cases had recovered. If the labyrinth had been opened accidentally during the operation, or if, as in some of the cases, the stapes had been removed, the fistula should be left entirely alone or the labyrinth should be taken out. In the presence of a suppurating ear, with the absence of labyrinthine symptoms, he was inclined to leave the patient alone, contrary to the practice of the German operators. He had one case last winter in which this plan was followed and the patient died. Where there was an indication of the complete obliteration of the labyrinth, it might be safe to remove the labyrinth and prevent further trouble, but this procedure was not necessary.

Dr. Wendell C. Phillips, New York City, referred to a case of labyrinthine necrosis which he had reported before the New York Otological Society. The cochlea was necrosed, and in curetting, he wounded the jugular bulb. Jugular bulb thrombosis promptly resulted. The vein was tied off. The patient subsequently had one abscess in the lung and another in the groin, but he recovered. He wished to go on record as believing that one should be extremely cautious in advocating opening the labyrinth or doing the labyrinth operation in so-called serous labyrinthitis. Serous labyrinthitis, in his opinion, was not a fatal condition, but, if operated upon there was always danger of a resultant meningitis.

Dr. George E. Shambaugh, Chicago, Ill., said that the indications for operations upon the labyrinth were very clearly defined and generally accepted in certain cases, while in other cases of labyrinth involvement there is still a distinct difference of opinion as to what the proper surgical procedure should be. For example, it is recognized that in all cases of serous labyrinthitis the operation on the labyrinth is not called for. The diagnosis of this condition from a diffuse purulent labyrinthitis is not always readily made, since there may be apparently as complete a suppression of function in serous labyrinthitis as in suppurative involvement. Wherever a vestige of function is left in the internal ear, whether in hearing or in the vestibular part, operations upon the labyrinth are contraindicated. In cases where the clinical indications exist for a radical mastoid operation and the examination shows a complete destruction of function of the internal ear, it seems best to operate upon the labyrinth and supply proper drainage from this region. It is especially, in the cases of acute involvement of the labyrinth, associated either with an acute or a chronic otitis media, where we find difficulty in deciding when to operate upon the labyrinth. Dr. Shambaugh is still of the opinion that when labyrinth involvement occurs in such cases, even where there is apparently at times a complete suppression of function, operation

on the labyrinth should be undertaken as a rule only in those cases where the clinical indications exist for a mastoid operation, or where the symptoms suggest a beginning intracranial process. One sees many cases of acute labyrinthitis which develop from acute reactions in the middle ear, some occurring in connection with an old middle ear process, which subside spontaneously.

Dr. Gorham Bacon, New York City, referring to the use of primary skin graft in cases of the so-called radical mastoid operation, recalled the fact that the late Dr. Gruening had reported a case in which death from meningitis followed the use of a primary skin graft. The speaker had always strongly opposed this procedure, especially when the dura or sinus were exposed, and he knew that some of his colleagues at the New York Eye and Ear Infirmary felt as he did. He personally knew of several fatal cases, due to meningitis, where primary skin graft had been used.

Dr. Phillips added that he wished to make as clear as possible the type of case which he thought should not be operated upon, and cited an illustrative case. A young woman with acute otitis media, with bulging of the drum membrane, and her physician performed paracentesis, in the course of which the stapes, he believed, was struck. When he saw her the next morning she had nausea, vertigo, and all the symptoms of labyrinthitis except the temperature. She was totally deaf on the affected side. He left her alone. It took a long time, but she eventually got well. He believed she had serous labyrinthitis. In another case, not his own, the operation of ossiculectomy was performed. In twenty-four hours there was nausea, vertigo, etc., and in forty-eight hours the temperature rose. There was no hearing. Pus was found in the cerebrospinal fluid, and the patient died from meningitis.

Dr. Wells P. Eagleton, Newark, N. J., emphasized the importance of the point made by Dr. Perkins relative to the

value of lumbar puncture in watching the progress of these cases. Referring to the essayist's supposition that because the case recovered it may have been serous labyrinthitis, he called attention to the fact that Dr. Perkins' case may have belonged to the type in which there is localized meningitis which, if not operated on, would have caused death. The speaker detailed such a case, in which there was a walled-off spot of infection in the lateral cisterna. As long as this was drained the cerebrospinal fluid was normal, and hence lumbar puncture was misleading. The collection of pus, on the posterior surface of the petrous portion of the temporal bone, was found at autopsy.

Dr. Ewing W. Day, Pittsburg, Pa., asked Dr. Phillips if he made the diagnosis of labyrinthitis from the high temperature, and if that must always be present. Dr. Phillips replied that the high temperature was not necessary to the presence of labyrinthitis, and that when there was a high temperature there was already a beginning meningitis. Dr. Day, continuing, took exception to Dr. Phillips' view. Concerning lumbar puncture, as mentioned by Dr. Eagleton, while he did not wish to say anything against his procedure, he believed that by it he had caused the spread of infection localized around the internal auditory canal. In certain cases he believed the infection may be washed down by lumbar puncture. The tendency of the fluid is upward, and it held the infection upward. By removing the obstruction and diverting the normal direction of the flow of the fluid around the brain one ran the risk of pulling the infection downward to areas not already infected. He cited a case in point: He made a lumbar puncture, getting sterile fluid. Three hours later he got fluid loaded with purulent matter. After the second tapping the whole picture changed and meningitis supervened very rapidly. He had pulled the infection down by creating a sort of fluid vacuum.

Dr. Perkins, in closing the discussion, said he had made no effort in the paper to show how to make a differential

diagnosis of serous and purulent labyrinthitis. It was impossible in some instances to diagnose serous labyrinthitis from manifest purulent labyrinthitis. Some of the Germans thought it better to take out the labyrinth, when this was the case; in this country, operators were generally more inclined to wait. If the spinal fluid remained normal and no more symptoms appeared, one might wait. He agreed with Dr. Day that the withdrawal of fluid from the lumbar region might tend to spread the infection; the information derived from lumbar puncture, however, would warrant subjecting the patient to this danger. Many cases passed into the latent stage, and many patients lived, although the radical operation was performed without interfering with the labyrinth. In other cases the mere traumatism of the radical operation, without interference with the labyrinth, would set up meningitis. It would be foolish to go into a labyrinth where the process is healed and the spaces occupied by bone and fibrous tissue. Rudin claimed that such a labyrinth shows compensation in the usual time. He would not feel justified in doing a labyrinth operation in such a case. If there were no compensation he would hesitate to perform the radical operation without at the same time draining the labyrinth. Regarding the matter of skin grafts, of course there were cases in which they should not be used. It would not be wise, for instance, to place skin grafts over a fistula in the horizontal semicircular canal, nor would he think of putting a graft over a diseased labyrinth. Where the radical cavity appears to be in good condition and is clean, he did not think the danger increased, or very slightly so, if the cavity is lined with a thin graft. He had performed over a hundred operations, many with skin graft, and the mortality was less than two per cent.

Dr. John B. Rae, New York City, questioned very much whether establishment of compensation showed anything at all as to the actual condition of the labyrinth. It is difficult to see what influence the healing or non-healing of a purulent labyrinthitis could possibly have upon the establishment of compensation.

Dr. Perkins added that he put all the responsibility regarding the matter of this theory of the production of compensation upon Rudin, assuming none himself. He hoped the matter would be settled in the near future.

THE STREPTOCOCCUS MUCOSUS CAPSULATUS AS A CAUSE OF MASTOID DISEASE.

By GORHAM BACON, M. D., F. A. C. S., New York, N. Y.

According to my experience the streptococcus mucosus capsulatus is the most insidious and destructive germ with which the otologist has to contend, and the question of an operation, when the mastoid cells are involved, is a most important one.

In 1905 Dr. George Sloan Dixon published in the Archives of Otology, Vol. XXXIV, part 6, a paper entitled "Report of a Case of Panotitis Resulting in Meningitis, with Pathological Findings," in which he reported the case of a nurse who was under my care in the New York Eye and Ear Infirmary. She entered the hospital on February 7th, 1904, and gave a history of an acute attack of otitis media which had begun six weeks previously. She had labyrinthine symptoms which, with the knowledge we have today, would have warranted an operation. There was no mastoid tenderness. On the fourth day after admission meningitis developed, and she died almost immediately.

In this paper Dixon says: "This case seemed to call for an examination of my bacteriological examinations during the past four years. They were found to comprise about 1,050 cases of acute and chronic purulent otitis, with and without mastoiditis. 2.75% of the infections were Friedlander's pneumococcus, or, more properly, the bacillus mucosus capsulatus." Of thirty cases due to the bacillus mucosus capsulatus, fifteen had existed for forty-two days or over, before operation. Of these, two had perisinous abcesses with Bezold perforation; one had perisinous abscess and cortical perforation with subperiostial abscess; four had epidural abscess (one of which died of meningitis), one had panotitis and died of meningitis; and one had brain abscess and also died. Six cases had subperiostial abscess."

Dixon further says: "Of those cases which had existed under forty-two days, four promptly recovered after paracentesis, but mastoid operation was required on the remaining ten, and all did well except one patient who died of pneumonia."

Such a report only emphasizes the virulency of this germ, and since that time I have taken particular pains to watch these cases most carefully, especially with reference to an early operation.

During the years 1914-1915, I had the four following cases in private practice:

Case 1 was that of Caroline R., aged 5, who was seen by me in consultation on May 12th. She had had lobar pneumonia one month before when both ears had been affected, and there had also been an acute inflammation of the throat and enlarged glands in the neck. The right ear had cleared up, but the left had been discharging for about three weeks. The left membrane had ruptured spontaneously two weeks before I saw her. There was slight tenderness over the mastoid tip, the temperature had been rising, a little higher each day, from 99.2° in the morning to 101° or 102° in the afternoon, and a culture showed that the streptococcus mucosus capsulatus was the cause of the infection. A simple mastoid operation was performed that same day at the Infirmary. As soon as the tip was opened pus poured out. There was a very large cavity and the whole mastoid cells were involved; softened bone and granulations were everywhere. The wound was dressed in the usual way and the child made an uneventful recovery. Her temperature was 99° before the operation.

Case 2 was that of S. L. P., aged 64, who came to me on April 15th, complaining of pain in the right ear, and giving a history of a feeling of fullness in that ear three days ago. Examination showed the membrane slightly red and swollen about the short process as well as the canal. There was also slight tenderness on pressure over the mastoid. He was given drops to use, but as the pain was not relieved, I opened the drum membrane under gas that same evening.

Some serous fluid and gas escaped. He was then directed to douche the ear frequently during the day. The pain seemed to yield to treatment, and he was apparently doing well until three days later when the ear stopped discharging and began to pain again. The patient felt very dizzy and almost fainted on attempting to rise on the morning of April 19th, and that afternoon the drum membrane was again incised under gas. On the 20th the ear was discharging freely and there was practically no dizziness. An X-ray picture showed cloudiness of the mastoid cells on the right side, and a culture showed the cause of the infection to be the streptococcus mucosus capsulatus.

The ear discharged very freely until April 22nd, when the perforation closed. On the 24th the patient felt very much better after the best night he had had for a long time, and the drum membrane seemed to be clearing. On the 26th of April it became necessary to open the drum for the third time. On the 29th there had been but a slight discharge, and the patient seemed to be in about the same condition as he was ten days before. A second X-ray plate showed a slight increase of cloudiness on the affected side.

A consultation with Dr. Lewis and Dr. Townsend was held, and Dr. Lewis and I strongly advised operation, which was done at the New York Eye and Ear Infirmary on April 30th. The usual incision was made. The bone of the outer cortex was extremely hard and very thick. The large tip cell was filled with pus and granulations, and the rest of the mastoid contained granulations and softened bone and some pus. The antrum was large. Everything was cleaned out and the wound packed with sterile gauze. The patient left the hospital in a little less than two weeks, and his recovery was steady, though a little slow. The wound was dressed in the usual way and gradually filled up. By June 11th there was one spot of bone still uncovered near the tip, and there was a small sinus at the tip leading into the soft tissues. That morning the patient came into my office with marked swelling, extending down into the neck, which had come on suddenly the night before. This seemed to be caused by

about a half teaspoonful of pus which I squeezed out of the same sinus, and by the next day the swelling had practically subsided, except around the tip.

The patient went away for the summer and was under the care of a local physician. He had been very much run down and this was undoubtedly the cause of the slow healing of the wound. The change of air to the country greatly improved his general health, and on his return to the city the wound was entirely healed and had been so for about a month.

Case 3 was that of J. W. A., who has been a patient of mine for a number of years, suffering from a chronic middle ear catarrh on both sides, and exostoses in each auditory canal. On December 20th I was called to see him by his family physician, as he had a severe cold and pain in the right ear. On examination I found some vesicles filled with blood in the canal which prevented a good view of the drum membrane. He was directed to syringe the ear every two hours with a solution of boric acid. The next afternoon, as the temperature suddenly went to 101° after being normal in the morning, and as there was some tenderness over the lower third of the mastoid bone, especially at the tip, I incised the drum under gas. After the incision the temperature was normal, but the discharge became more profuse and purulent and the tenderness over the mastoid was quite marked, especially over the tip. A culture was made and showed that the streptococcus mucosus capsulatus was the cause of the infection. A blood count showed the polys as high as 78%, and the leucocytes ranging from 5000 to 6000.

An operation was performed at the New York Eye and Ear Infirmary on December 25th. The usual incision was made. Pus was found, under pressure, in a large cell in the lower third of the mastoid. The outer cortex was very hard, especially over the antrum. A very large antrum was filled with soft bone and many granulations. The dura was uncovered to a very small extent in the middle fossa. The wound was packed with idoform gauze in the upper part, over the dura, and with plain gauze in the lower part.

The patient left the hospital on January 8th, and the wound was dressed in the usual way. He was considerably prostrated by the infection, which seemed to pull him down very much, and as a result the wound was slow in healing. By the first of March it was practically healed and the patient went South. He returned the first of April, greatly improved in his general health and with the wound in excellent condition. The hearing of the right ear is practically the same as that of the left, though that of both is somewhat impaired, owing to his old catarrhal trouble.

It is interesting to note in connection with this case, that a urinalysis, made just before the operation, showed the presence of some albumin and a few casts, evidently due to the poison, as an analysis made a month previously showed no abnormal conditions.

Case 4 is that of Paul B., a medical student, who was seen by me in Roosevelt Hospital in 1914. He had an acute inflammation of the ear which was due to the presence of the streptococcus mucosus capsulatus. The ear had discharged spontaneously before I saw him, and there was slight tenderness over the mastoid bone. Five X-ray plates were taken of the mastoid bone. The first three plates were cloudy but the fourth showed a less cloudy appearance and the final one was so much cleared up that I decided not to operate, as the drumhead had resumed its normal appearance and all tenderness on pressure over the bone had disappeared.

The following cases are a few of those treated in my clinic at the New York Eye and Ear Infirmary during 1913, 1914 and 1915.

1. Barney G., a Russian, aged 53, came to the Infirmary on May 1st, 1913, and gave the following history: Pain in the right ear began six weeks ago following a cold. He suffered pain every night for over four weeks, and two weeks ago noticed a slight purulent discharge which has continued up to the present time. The drum membrane was incised in the clinic, and on the next day a postauricular swelling appeared and gradually increased in size. Examination showed slight discharge from the right ear, the superior wall

was sagging, the drum membrane red and bulging, and a perforation in the lower part. There was tenderness on pressure over the mastoid area, especially over the antrum. A culture was made and found to be the streptococcus mucosus capsulatus. An X-ray plate showed the left mastoid clear, with large pneumatic cells. The right seemed to be completely disorganized; two localities suggested perisinous and epidural abscesses,—the former below and the latter near the knee of the sinus. Three days after admission to the hospital a simple mastoid operation was performed and soft pneumatic cells were found with large perisinous and epidural abscesses. The tip was also removed. The temperature on admission was 99.2°; after the operation it rose to 101.6° but gradually came down to normal. The patient was discharged from the hospital on June 14th, and the subsequent dressings were done in the Out-Patient department.

2. Thomas D., Irish, aged 55 years, was admitted to the Infirmary on October 21, 1913. His illness began on August 15th, with a severe attack of pain in the left ear which continued until the drum membrane ruptured, twenty-four hours later. Following that, there was intermittent discharge and occasional attacks of pain, none of which were severe, and he was advised to come into the hospital because of the discharge and tenderness over the mastoid. A bacteriological examination showed the streptococcus mucosus capsulatus. The X-ray showed the right mastoid with moderate-sized cells of the pneumatic type; the cells were clear. The left mastoid seemed to be similar, but very cloudy. The sinus was far forward and looked as though it might be under the canal. A simple mastoid operation was done October 21st, revealing a large perisinous and epidural abscess, and a mass of dark necrotic granulations filling the antrum. The dura under the middle fossa was exposed, and the sigmoid sinus for a considerable space. The temperature was 96.2° on admission, and immediately after the operation went to 101°, fluctuating between that point and 98° for four days until it became normal. The patient was discharged from the

hospital on November 6th, and after that the wound was dressed in the Out-Patient department.

3. Fred G., an American, aged 21, was admitted to the hospital July 25, 1913. He gave a history of pain and deafness in the right ear on July 7th, following sea bathing. The drum membrane ruptured, and he came to the clinic the next day with a profuse discharge from the ear. He was admitted to the hospital for observation, and the drum membrane was freely incised. There was slight sagging of the posterior and superior wall and moderate pain. Examination of a smear showed strong suspicion of a streptococcus mucosus capsulatus, but Dr. Dixon could not be sure of it. The x-ray showed a moderate sized pneumatic mastoid with extensive development of zygomatic cells, all of which were clear. The right side was cloudy throughout. The sinus seemed superficial and there appeared to be perisinous and epidural abscesses. The usual operation was performed on the right ear on July 31st. The bone was of the large pneumatic cell type filled with soft necrotic granulations. A large extent of dura was exposed, and the sinus was exposed and healthy. The top and zygomatic cells were carefully cleaned out. The patient was discharged on August 8th, and treated afterward in the clinic.

4. Rose K., a Russian, aged 21, was admitted to the hospital on September 2, 1913, with a history of pain in the left ear five weeks before, following a cold. The drum had been incised one week before, and since then there had been a slight purulent discharge. Pain had been severe for the past few days with pain behind the auricle. Examination showed the left ear filled with thick pus. The drum membrane was bulging and perforated, with sagging of the posterior superior wall, and there was slight tenderness on pressure over the mastoid antrum and tip. A bacteriological examination showed the cause of the infection to be the streptococcus mucosus capsulatus. The x-ray showed the right to be a moderate-sized clear pneumatic mastoid, with a number of zygomatic cells. The left was of the same type,

but very cloudy throughout. Operation was advised, but refused, and the patient left the hospital on September 7th.

She came to the Infirmary again on September 13th, and on the 16th a simple mastoid operation was done on the left ear. The outer cortex was rather thick, and the bone was of the moderate sized pneumatic type. There was no free pus. There were necrotic granulations, and the bone was broken down. The zygomatic cells were cleared out, the tip was removed, and a small area of dura in the antrum and middle fossa was exposed. The patient was discharged on October 2, 1913, and treated afterwards in the clinic.

5. Adolph R., a Roumanian, aged 59, came to the Infirmary on June 3rd, 1913. His trouble began three months before, following exposure to cold. He had pain in the left ear for the first eight days and then had no trouble, except an occasional rumbling noise, until two days before he came to the clinic, when the pain recommenced with a discharge. Examination showed a slight foul discharge from the canal, the membrane red and bulging, with slight sagging of the posterior and upper canal wall. There was no mastoid tenderness. The patient had diabetes. The bacteriological examination showed that the infection was due to the streptococcus mucosus capsulatus. A blood count showed the white cells 7,100, and the polys 61%. The X-ray showed the right mastoid to contain large pneumatic cells. The left was of the same type but cloudy throughout, disorganized below and behind, and probably an epidural abscess near the knee. There were high zygomatic cells. A simple mastoidectomy was done. There was very extensive disturbance of the cells, pus in the antrum and tip, and both an epidural and a perisinous abscess found. The patient made a good recovery.

6. Jacob S., an American, aged 19, came to my clinic on November 19th, 1912, with acute pain in the right ear of one week's standing. The membrane was red and bulging and was incised. The pain was relieved at once. There was little, if any, discharge. On December 30th, the patient noticed pain over the mastoid and the discharge increased in quan-

tity. He came to the clinic again on January 5, 1913. Examination of the right ear showed a slight thick discharge in the canal, which was constricted throughout and sagging in the posterior and upper portion. There was a small perforation in the drum head, and slight tenderness over the mastoid antrum on firm pressure. The cause of the infection was the streptococcus mucosus capsulatus. An X-ray showed both mastoids to be of the large celled pneumatic type, the right being hazy throughout especially above and behind the antrum. The temperature was 98°. A simple mastoid operation was performed and free pus was found in the antrum and tip. There was a perisinous abscess. The patient was discharged from the hospital on January 14th, and treated in the clinic.

7. Christian S., a Greek, aged 30, came to the Infirmary on June 23, 1914, with a history of continuous and moderate discharge of one month's duration. He had had no severe pain. There was diffuse postauricular tenderness and considerable sagging of the upper and posterior wall of the canal. The drum membrane was almost occluded. The bacteriological examination showed the streptococcus mucosus capsulatus. The X-ray examination showed a large clear-celled pneumatic mastoid on the right, and on the left the same type, but cloudy throughout. On operation, an epidural abscess was found, and a large area of dura was exposed. The sinus, covered with granulations, was also exposed. There was a very extensive and destructive process. The temperature was 99° on admission, and after the operation went to 100.3°. The patient was discharged on July 13th, and treated subsequently in the Dispensary.

8. Mary A., an Austrian, aged 36. Her illness began with severe pain in the left ear following a chill, four weeks before her admission to the hospital on September 8, 1914. The pain gradually increased in severity until the drum was opened. Her temperature on admission was 99.2°. The cause of the infection was the streptococcus mucosus capsulatus. Operation showed the diploetic type of bone. The entire process was extensively involved, and there was

a perisinous abscess. There was no involvement of the posterior sinus cells. The tip was removed and a large area of dura was exposed. The patient left the hospital on September 17, 1914.

9. Max B., an Austrian, aged 32, was admitted to the Infirmary on May 18, 1915. He gave a history of pain in the left ear ten days before. Two days after the pain began, he came to the clinic and the drum was incised. Discharge continued until the day before his admission to the hospital, when it ceased and the pain began again. There was great tenderness on pressure over the tip, some constriction of the canal, and the drum membrane was swollen, reddened, congested and bulging. The bacteriological examination showed the presence of the streptococcus mucosus capsulatus. The X-ray plate showed a large mastoid, right, with extensive zygomatic cells. Cells were also present about the antrum. The left was a very large pneumatic mastoid, comparatively cloudy. The report from the laboratory characterized this as "probably an operative case." His temperature on admission was 101°. The operation revealed the cells filled with pus, and great destruction of the bone. The large and tip cells were filled with pus under pressure. The sinus was covered with granulations forming a perisinous abscess. The patient left the hospital on May 28th.

10. David D., a Scotchman, aged 68, came to the hospital on June 18, 1915. He first had pain in his left ear five weeks before. The drum was incised one week later and again three weeks after that. Two days after the last incision he developed severe pain in the ear and tenderness posterior to the auricle, and the discharge became more profuse. There was tip tenderness over the mastoid and a thick purulent discharge. A linear perforation was seen in the drum membrane. The laboratory reported the presence of the streptococcus mucosus capsulatus. The x-ray showed both mastoids of the pneumatic type with thick cortices. The right was fairly clear and the left quite cloudy. A simple mastoid operation was done on the left ear, and the mastoid

cells were found filled with granulations and pus. The tip was completely removed. No sinus or dura was exposed. The temperature on admission was normal. The patient was discharged on June 30th, and treated in the clinic.

11. Herbert F., an American, came to the clinic on March 4th, 1915, with a history of slight pain three weeks before. The ear had felt stopped up and deaf, and finally had ruptured spontaneously. Slight pressure over the tip caused pain. There was no sagging of the canal wall. The discharge was moderate. There was marked bulging of the drum membrane. A culture showed that the streptococcus mucosus capsulatus was the cause of the infection. The X-ray showed the right mastoid to be a moderate-sized clear pneumatic. The left was of the same type, but cloudy throughout. The usual mastoid operation was done. There was extensive involvement of the mastoid cells, which were filled with softened bone, granulations and thick pus. The temperature was 100° on admission.

From an analysis of these cases it will be seen that some patients complain of slight pain, and others of very severe pain, but that there was extensive destruction of the mastoid cells in all cases that came to operation, particularly in the Hospital cases. There was both a perisinous and an epidural abscess in seven of the eleven Hospital cases, and in two others the dura was exposed. In two of the private cases, also, the dura was exposed.

The X-ray is a most valuable aid in deciding upon the advisability of an operation. If a mastoid, which was previously shown to be cloudy, begins to clear up, and the symptoms show a steady improvement, I feel that we can afford to wait if the patient is carefully watched, and if a sufficient number of X-ray plates are taken. Such was the method pursued in the case of the patient who escaped operation. If, on the other hand, a patient is under treatment and the discharge persists while all tenderness on pressure over the bone has disappeared, it is more than likely that a destructive process is going on in the mastoid cells, and we are likely to find an exposed dura and sinus, particularly if

the condition continues for from three to six weeks. A blood count is generally of little value.

In conclusion, I desire to call your attention to the following points:

1. The patient may have very severe pain, or the pain may be slight, and the temperature is seldom much above normal.

2. The discharge in some cases is very profuse, while in others it is slight, and there may or may not be sagging of the posterior and upper canal wall.

3. The X-ray is a most valuable aid as the cells on the affected side will be cloudy, and in some instances it is possible to detect an epidural or perisinous abscess.

4. We should err on the safe side and operate when in doubt, for we often find a great destruction of bone, even in cases that present few symptoms. It is only in a few cases, which yield readily to treatment that an operation can be avoided.

Discussion.

Dr. E. B. Dench, New York City, agreed with Dr. Bacon that streptococcus mucosus capsulatus infection was very insidious, and apt to cause great destruction to the mastoid. The result, however, depended upon how early the case was seen. He had reported thirteen cases, two of which went on to mastoiditis, while eleven made a perfect recovery. Regarding the question of repeated myringotomies in these cases, he thought if myringotomy would relieve the case at all one would do it, provided it was a satisfactory operation. He could conceive of how one might fail to secure proper drainage in performing a myringotomy on a struggling child without an anesthetic, and that in such cases it would be necessary to repeat the operation, but if one did a satisfactory myringotomy he did not believe it would be necessary to repeat it. When the infection was so insidious and the deeper structures so involved that one myringotomy would not clear up the infection, he thought it better to go into the mastoid. He recalled a case of this infection in which, dur-

ing two months, the patient had had ten myringotomies. There was relief of pain, but at operation the mastoid was found completely broken down, and the sinus exposed.

Dr. Sargent F. Snow, Syracuse, N. Y., was in accord with Dr. Dench with regard to the matter of repeated myringotomies, though in some cases it might be necessary, for certain reasons, to make repeated incisions of the drum membrane. He had had two or three such cases. The main thing is to have the initial incision a free one, extending well up into the attic folds.

Dr. George L. Richards, Fall River, Mass., agreed with Dr. Dench that one good incision of the drum membrane should suffice. He was surprised at the report of cases of recovery from streptococcus mucosus capsulatus infection without operation. He had been a pupil of Wittmack, of Jena, who operated as a conservative matter, even without the characteristic symptoms, and he had hesitated to break the rule.

Dr. Bacon, in closing the discussion, agreed with what had been said with regard to the dangers of delaying operation. There was only one case of the four private patients in which he did not operate, the reason being that the membrane, the hearing, and all the local symptoms cleared up; and inasmuch as the X-ray plate showed clearing up of the cells, he thought it but fair to the patient to hesitate. With reference to doing only one paracentesis, he would not like to feel, after so many years of practice, that, if he had to repeat the operation, it was because he had not done it correctly in the first place. He knew a good many colleagues whose patients escape a mastoid operation after repeated incisions of the drum membrane. He would not like to subject a patient to the mastoid operation after only one paracentesis. He cited the case of a child whose parents would not consent to operation. He performed paracentesis fifteen times, and the child recovered, with perfectly good hearing. Answering a question by Dr. Shambaugh, as to the indica-

tions for a subsequent incision of the drum membrane. Dr. Bacon said the incision should be repeated when drainage has ceased because of the closing over of the opening.

SOME PHASES OF AURAL DISEASE.

By S. MacCUEN SMITH, M. D., Philadelphia, Pa.

Although many of us have agitated the question for a number of years, it is still apparent that an incredibly large percentage of the medical profession possesses a very meagre appreciation of the danger signals of aural afflictions.

Formerly, on account of lack of knowledge of the ear and its diseases, this apathetic attitude was comprehensible, but considering the widely disseminated educational campaign of recent years on pathologic otology, I feel that we have not achieved a success commensurate with our efforts.

Two principal reasons seem to be responsible for this indifferent attitude both on the part of some members of the profession and of the public; the latter is well illustrated by the old adage of our forefathers of some generations ago, born of their ignorance of the subject, that it is dangerous to interfere with a discharging ear; the second and more important reason why this false impression still lives and struggles so tenaciously for its existence is due to the fact that some aurists yet adhere to the ultra-conservative method of treating acute suppurative diseases of the ear. We are all aware that occasionally a case, though presenting more or less alarming symptoms, will effect a spontaneous cure with operation. However safe this practice of "watchful waiting" may be in the hands of an expert, I believe it most dangerous to follow as a routine method of treatment even for the usual skilled aurist. The truth of the matter is that, even with the aid of Roentgenography, we are, many times, unable to estimate the exact degree of destruction taking place in an acute suppurative inflammation of the organ of hearing, or the direction in which this destructive carious erosion may proceed. Therefore, it seems most unwise to wait until grave symptoms, probably indicating an intracranial complication, present themselves before resorting to operative intervention.

I do not wish to be understood as advocating, for instance, a mastoid operation in cases of acute inflammation without making every effort for their non-surgical relief, but I do consider it unfortunate to wait purposely until there occurs a carious erosion through the cortex or through the tip, resulting in the characteristic swellings, before operation is advised.

Modern aseptic surgical otology has rendered the mastoid operation, if performed early, probably the most successful procedure in all surgery. Furthermore, early surgical intervention will not only prevent the various intracranial complications, in most instances, but will also almost assuredly preserve the hearing.

Some phases of this subject are forcibly illustrated by a few interesting cases which I will briefly cite.

In former years, when a diagnosis was doubtful, it was convenient for the medical profession to designate many such cases as malaria. In more recent years this malarial incubus has been banished, through the enlightenment of the popular mind, only to be replaced by the omnipresent influenza, a term at present quite acceptable to the public mind, even though the condition be non-existent, and today we have the bacillus of Friedländer arraigned at the bar as indiscriminately as was formerly the supposed miasma of malaria.

The following case of brain abscess well illustrates the error into which physicians are liable to fall, owing to incomplete diagnostic methods:—

Male, 60 years of age, enjoyed exceptionally good health up to six weeks previous to operation, which occurred three years ago. Patient complained bitterly of general head pain, which was somewhat relieved by exerting severe pressure with his hands. This condition continued for a period of two weeks without additional manifestations. During this time he was advised to remain in bed, but refused compliance. At the end of two weeks he gradually became stuporous, with occasional lucid intervals, and so remained until the time of his death, four weeks later. Two

weeks before he died he was removed to the hospital to be kept under observation. At the onset of his illness he was supposed to be suffering from influenza, and later, on account of having chills every second or third day, his malady was diagnosed as malaria, but a blood examination failed to confirm this suspicion.

I was walking past this patient's room with the resident physician, and my attention being attracted by his labored breathing, I remarked to the resident that it sounded like a patient suffering from a brain abscess. I was informed that a diagnosis had not been made, although the patient had been treated for the two diseases above mentioned. The resident asked me to examine the man, but as the case was a private one I was unable to comply with his request. Two days later, however, a spontaneous rupture of the right membrana tympani occurred, followed by the same condition in the left ear early the next morning. At this time I examined the man, and performed a simple mastoid operation on the right ear, and, on account of the great destruction, a radical operation on the left side. There were no exposures on the right side, but on the left we found a perisinus abscess formation, as well as a large carious exposure of the dura through the tegmen antri and tegmen tympani, well covered with granulation tissue, through the center of which pus escaped.

The interesting points in this case are that although the patient complained of severe head pains for a period of six weeks prior to the operation, he did not at any time locate this pain definitely in either ear. This no doubt was responsible for the failure to have an aural examination. The second point of interest is one of very common occurrence,—the tendency, in the absence of an exact diagnosis, to pronounce an influenzal state the causative factor. It does not seem to be generally appreciated that confined pus within the tympanic or mastoid cavity will give symptoms simulating those of influenza, the result being that the ear, which is so frequently the only part of the organism involved, is entirely overlooked, showing the wisdom of a

routine examination of the ear in a case of doubtful diagnosis. This is of especial importance in children. Indeed, a failure to examine the ear would seem to be almost criminal neglect in many instances.

It is quite true that in this case the aural involvement may have been secondary to an influenzal infection, but, granting this, it would not explain the chills and semi-comatose state which were continuous during the last week of the patient's life and latterly attributed to malaria.

Inasmuch as this patient, as above stated, did not complain of actual aural pain, it is not amiss to emphasize to the general profession that there are two distinct types of acute aural inflammation, one in which the symptoms are frank and very severe; the other type in which the symptoms referable to the ear are almost nil, even in the presence of most extensive destruction, and yet in this latter class the existence of aural disease can be determined on examination by an expert.

The second case well illustrates the folly of procrastination in some acute aural afflictions:—

Male, 7 years of age, contracted an acute suppurative otitis media, complicating a so-called "cold in the head." The ear was entirely overlooked for a period of two weeks, during which time the child suffered severely from general head pains, no aural trouble being suspected until a discharge through a spontaneous rupture of the membrana tympani was discovered by the nurse, the temperature ranging meanwhile from 99°+ to 104°. The spontaneous rupture was in the superior-anterior quadrant, and was, therefore, enlarged and the middle ear aspirated. The pain and fever were lessened for two days only, and during the following week ranged as heretofore. It was impossible, on account of the child's fretfulness, to determine definitely the presence of tenderness on pressure over the mastoid process.

On several occasions I suggested to the attending physician the advisability of performing a mastoid operation. He, however, on account of the importance of the child, who was the sole heir to an enormous estate, hesitated to

assent to this suggestion. On the ninth day following the spontaneous rupture, there appeared a distinct drooping of the superior-posterior wall. A mastoid operation was then urged and again refused, the same reason being given. The following day the child's mentality seemed to me to be somewhat cloudy. It was asserted, however, that this was due to a wakeful night. At this juncture I advised the medical attendant and the family that unless they consented to operative intervention, I would no longer assume the responsibility of the child's condition. This attitude resulted in another consultant being called, who in turn gave as his opinion that he saw no reason for immediate operation, although he felt that one might be necessary eventually. This verdict was pleasing to both the child's physician and the family.

Eight days later I was summoned in great haste to see this child, being requested to bring my instruments with a view of immediate operation. On arrival I found that the patient had been semi-conscious for two days, opisthotonos was present, several severe convulsions were reported, the temperature ranging as high as 106°+, and death ensued within the next half-hour, without the patient having the benefit of surgical intervention.

With this history, it is needless to state that the boy succumbed to a diffuse, purulent meningitis, all of which, to my mind, would have been prevented had an early operation been permitted for the evacuation of the infectious material.

The last case I shall outline shows another form of aural disease, not quite so common but just as grave:—

Male, 41 years of age, suffered from a chronic recurrent suppurative otitis media for thirty-eight years, the disease complicating an attack of measles at the age of three years. Until the last five years preceding operation, the patient was not conscious of the slightest discomfort other than the annoyance of the discharge when present. During the last five years, however, he suffered almost constantly from what was termed a mild form of neuralgic headache, this at times becoming very severe. His general health was much im-

paired, to such an extent, indeed, that he was unable properly to attend to his large interests. This condition culminated in the patient being found unconscious in the drawing room of a train between New York and Philadelphia. He was taken from the train to the hospital, where, on account of a foul-smelling discharge escaping from the ear and the absence of any other symptoms to account for his condition, I performed a radical mastoid operation. The cortex was ivory-like in density, the antrum decidedly small and the sinus pushed far forward. The middle ear and antrum were well filled with considerable cholesteatomatous material and foul-smelling pus. The dura was exposed by carious erosion through the tegmen tympani, through an opening in which a quantity of pus escaped. With dilating forceps an additional amount of pus was evacuated from apparently the temporosphenoidal lobe.

This patient completely recovered in due course and returned to his duties, and only recently expressed the opinion that he had never known what it was to feel really well and vigorous until after this operation. He has increased in weight and enjoys most excellent health.

Cases of neglected aural disease might be indefinitely enumerated not only in my practice, but in that of us all. My object, therefore, in presenting this elementary note is for the purpose of soliciting on the part of my colleagues a continuation of our educational program.

Discussion.

Dr. John F. Barnhill, Indianapolis, Ind., thought the general practitioner and the general public, more perhaps than the otologist, should hear such a paper. The dangers connected with otology were not known as they should be. Abdominal surgeons had not been backward in letting the public know of the dangers lurking in that region. He was reminded in this connection of a statement made a few years ago by Dr. Robert T. Morris, of New York, to the effect that if a lantern were hung over the grave of everyone who died

of appendicitis, all graveyards would be well lighted. The dangers which Dr. Smith had put forward were not so well known. It had been his own custom to enlighten his patients as far as possible along these lines, and he believed otologists should inaugurate a propaganda of education.

Dr. Smith, in closing the discussion, merely wished to apologize for bringing before the Society such an elementary subject, his purpose being to further a continuation by otologists of the education campaign begun a few years ago among general practitioners.

REPORT OF A CASE OF SPONTANEOUS HEMORRHAGE FROM THE EAR.

By JOHN B. SHAPLEIGH, M. D., St. Louis, Mo.

On November 23rd, 1915, Mr. W. C. M., 36 years old, consulted me on account of severe pain in the right ear, of two days duration, following a severe grippe cold. His general health had always been good, but he was verging on a nervous break-down from long continued over-work, and for some time before the present trouble began, he had complained of soreness in the neck and pain in the legs which he had considered to be rheumatic. This tenderness in the neck had not entirely disappeared and was found to extend from the occiput and from below the mastoid on the right side to the shoulder but posterior to the sternocleido-mastoid muscle. There was no mastoid tenderness.

The right ear showed a typical acute attic suppuration; the membrana tympani being intensely red and bulging above, with the lower portion practically normal. The usual incision was made through the bulging Shrapnell's membrane and out onto the canal wall. The bleeding was only slight and quickly ceased. The pain in the ear was promptly relieved, but the right side of the head continued to feel full and uncomfortable. There was a free purulent discharge for a few days, but this ceased in about a week with no return of pain or fever, and on December 3rd the ear was found to be dry, with no perceptible bulging of the membrana tympani, no mastoid tenderness, and only slight discomfort in the head.

On December 16th, the ear was still dry. The hearing was poor and there was some tinnitus. The membrana tympani now showed some bulging in its upper portion but very little congestion. There was slight tenderness over the mastoid and back of it. No fever. The possibility of a beginning mastoiditis was considered and another incision of the bulg-

ing drum membrane advised. He refused, however, to allow this to be done at this visit. Two days later, on December 18th, the mastoid tenderness and the bulging of the membrana tympani still being present, the membrane was again freely incised, and again with only ordinary bleeding.

He was seen again on December 20th, when there was found a moderate, purulent discharge from the ear. The mastoid tenderness had entirely disappeared, and he complained of nothing except an uncomfortable sense of fullness on the right side of his head.

December 21st. This forenoon the patient telephoned that his ear had bled twice that morning; the first time about a tablespoonful, the second about a teaspoonful. Both times the bleeding stopped spontaneously, and afterward the ear and head felt better. He also said that there was no pain in the ear and no tenderness behind it and that it was still discharging. The next morning, December 22nd, I received a telephone message from Dr. Hastings, of Alton, Ill., where the patient lived, saying that he had been called during the night to see Mr. M. on account of severe hemorrhage from the ear. On his arrival he found that the bleeding had stopped, but not before the patient had fainted. There had been considerable purulent discharge from the ear during the previous day but no pain nor tenderness. He simply packed the ear with gauze. The doctor could give no exact statement as to the amount of blood lost but thought it must have been very large, since the patient had fainted and he found him very pale and weak, with a scarcely perceptible pulse. He saw in a bowl about a pint of clot. The patient's account of the attack is as follows:—"He had gone to bed feeling quite well. During the night he had a coughing spell and at once felt something running from his ear, but had no pain. By the time a light was obtained his pillow, was saturated with blood. Not being able to stop the bleeding, he held a bowl under his ear to catch the blood, and sent for the doctor, but before the doctor came he fainted. The blood did not come in spurts but simply poured out. It was dark in color. He could not tell how much blood he lost

altogether, but there was at least a double handful of clot in the bowl."

December 23rd. The doctor reports a good night. No recurrence of the bleeding. Pulse better. No fever. No pain about ear or mastoid. There is some tenderness in the neck but none in the jugular line, and the patient says this tenderness is the same he had previously had and for which he had consulted an osteopath a few months before. The tampon was renewed.

On December 24th, I saw the patient. He was still very pale and weak. Pulse fairly good but soft and compressible. No pain in ear or head. Mastoid not tender but neck back of sternocleido sensitive and painful. No jugular tenderness. Complains of pain in his legs. Temperature has not been above 99 F. The external canal was negative and contained no clot. Its walls presented no suspicious spot of congestion or abrasion. The entire drum-membrane was of a bluish black color.

January 7, 1916. Dr. Hasting's report. Patient rapidly improving. Is up and around. Temperature has not been above 100 F. Pain much less in neck and gone from legs. (He had been given Potassium Iodide for about a week.) Watch heard two inches or so from the ear.

There is little more to report. Toward the end of January he went to Florida. On the way down, there was pain in the ear with swelling in front of the tragus. The hot douche promptly relieved this and there was no further trouble. It was probably a furuncle. When I last saw him, March 28th, the membrana tympani looked quite normal. It was slightly grayish but the landmarks were distinct and the light spot brilliant. Hearing for a 72-inch watch was 9 to 12 inches, and for whisper, about 12 feet. There was no tinnitus but at times a slight feeling of heaviness on the right side of the head.

As the story of an acute attic suppuration this case is unimportant, but the question of the source and causation of such a severe spontaneous hemorrhage seems to offer an interesting field for speculation.

It seems unlikely that so rapid and profuse a flow could have come from any of the blood vessels usually found in the drum-membrane or middle ear, and the internal carotid, the lateral sinus and the jugular bulb suggest themselves as possible sources. An arterial source may probably be excluded since the dark color of the blood and the absence of spurting or even pulsation in its flow, as described by the patient, suggest a venous origin.

To consider it as coming from the sinus implies either an incompleteness of the bony partition separating this vessel from the tympanum or antrum, or a perforation of this partition by caries and an ulceration of the sinus wall without the formation of an obstructing thrombus. I do not think that any carious process existed in this case. The prompt disappearance of all mastoid symptoms after incision of the membrana tympani and the subsequent history of the case indicate that what mastoid tenderness there was, was due to pus retention and not to bone involvement. As to the anatomical anomaly of the sinus suggested, I do not know that it has been found. It seems more probable that the blood came from the jugular bulb, for we know that dehiscences in the floor of the tympanum sometimes exist whereby the wall of the vein is brought into immediate relation with the lining of the tympanic cavity, and cases have been reported where the bulb was so exposed in the middle ear that it was punctured in an ordinary paracentesis. Under such conditions, direct infection of the vessel wall from a suppurating middle ear might easily occur.

Granting such an anatomical anomaly in this case, the hemorrhage may possibly be explained by supposing that after the second incision of the membrana tympani the pus found its way into the lower tympanic cavity with resulting infection and ulceration of the jugular bulb. Two small hemorrhages in the morning came from a minute perforation in the wall which the clot was able to seal. The severe bleeding at night was preceded by coughing. During coughing or forced expiration the venous return from the head is impeded, the jugulars become distended and the pressure on their

walls is increased. This effect is felt much more in the vein and bulb than in the sinus. The weakened wall of the bulb could not withstand this suddenly increased strain due to the coughing and gave way. The flow was rapid enough to prevent clot formation in the middle ear or canal till the syncope slowed the circulation. Then the bleeding ceased. Its recurrence was prevented because the clot in the tympanum was held in place by the membrana tympani until either the wall was healed or the bulb occluded by a thrombus.

In an imperfect search through the literature, I have found reports of hemorrhage from the ear in patients who were "bleeders"; and cases of arterial hemorrhage following paracentesis of the membrana tympani have been reported by Dr. Selden Spencer (1), Dr. McKernon (2), and others. In Dr. Spencer's case, the bleeding was supposed to have resulted from puncturing an aneurism of some tympanic artery, while in McKernon's, the supposition was that an artery had ruptured previous to the paracentesis. In his article, Dr. McKernon mentions a case reported by Dr. Dench (3), where in operating for removal of the ossicles the jugular bulb was opened with a curet, severe venous hemorrhage resulting, and later jugular thrombosis. There was evidently here a dehiscence in the tympanic floor. He also refers to cases reported by Ludwig (4) and Hildebrandt (5), in both of which severe venous hemorrhage followed a paracentesis in the lower part of the membrane. Evidently in these the bulb must have been well up within the tympanum. These were operative accidents, and I have not found a report of spontaneous hemorrhage such as occurred in the case here presented. The three cases of venous hemorrhage quoted, however, confirm the anatomic condition upon which rests my theory, for it is only that, of this being a jugular bulb hemorrhage.

Another interesting feature of this case is the absence of subsequent suppurative complications. Up to the time of the hemorrhage there had been a purulent discharge from the ear and for several days after it an infection of the

lateral sinus or jugular, or at least a breaking down of the clot in the middle ear with recurrence of the bleeding was feared. Nothing happened, however; there was no reaction, and the existing suppuration ceased at once and permanently. Was it because the infecting organisms had so far lost their virulence that those left after this thorough flushing of the ear were unable to maintain themselves?

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Discussion.

Dr. E. B. Dench, New York City, recalled a case in which he wounded the bulb at the junction of the floor of the tympanum with the floor of the canal. In another case, in demonstrating the radical mastoid operation, he found a suspicious looking point, while clearing out the hypotympanum, which bled freely. He immediately tucked in a little piece of gauze, and this bleeding ceased. He had opened the dome of the jugular. He put in a skin graft, lining the entire cavity except that portion occupied by the gauze packing inserted to stop the bleeding. The patient made a complete recovery.

Dr. Shapleigh, in closing the discussion, said he did not know whether the hemorrhage in his case could have been stopped, as there was nobody present to observe it. The family probably put in some cotton. It had stopped by the time the doctor got there. The interesting features of this case are the origin and causation of the bleeding, and the absence of subsequent infection. He had hoped that some theory to explain these points might have been advanced.

DEVELOPMENT OF THE CISTERNA, SCALA VESTIBULI AND SCALA TYMPANI IN THE HUMAN EMBRYO.

By GEORGE L. STREETER, M. D., Carnegie Institution of Washington, Department of Embryology, Baltimore, Md.

The tissue in which the periotic spaces develop is derived from a mass of condensed mesenchyme that forms around the otic vesicle in embryos between 4 mm. and 10 mm. long. This mass is subsequently differentiated into a cartilagenous capsule that completely invests the membranous labyrinth except for the three openings that are to become the internal auditory meatus, the aquaeductus cochleae, and the aqueductus vestibuli, which openings are indicated from the very earliest stages. The cartilagenous mass originally is everywhere in direct contact with the epithelial wall of the labyrinth. In embryos, however, about 14 mm. long the tissue in the immediate neighborhood of the epithelial walls undergoes a dedifferentiation, so that all around the labyrinth, conforming to it in shape, an area is established that is less like cartilage and more like embryonic connective tissue. It is this that is the foundation for the open-meshed periotic reticulum which in embryos 30 mm. long everywhere bridges the space existing between the membranous labyrinth and the surrounding cartilage. The membrana propria that supports the epithelial part of the labyrinth and the perichondrium lining the cartilage are both derived from this periotic reticulum. It is also a modification of the meshes of this same reticulum that results in the formation of the so-called *perilymphatic spaces* of the labyrinth, or, since they are not really lymphatic spaces, the *periotic spaces*, the development of which is the topic of this paper.

Unmodified periotic reticulum is characterized by a rather uniform narrow mesh. The essential change it undergoes in the process of space formation consists in the disappearance of some of the trabeculæ of the mesh, followed by the coalescence

of the corresponding adjacent spaces. The trabeculæ consist of the protoplasmic processes of the constituent cells of the reticulum, and their disappearance is probably to be explained not by a dissolution or liquefaction of these cell-processes but by an alteration in their form. It apparently is the result of an active motility of cell protoplasm involving the detachment and retraction of one trabecula after another. When a trabecula becomes detached it gradually retracts and adapts itself to the formation of a larger space, re-shaping itself as a smooth border or as a constituent part of another trabecula. As spaces become larger, longer trabeculæ are required; and as trabeculæ become longer they also tend to become heavier. These phenomena are plainly evident in sections of the scalae which are in the process of spreading and enlarging. The differentiation of the margin of the periotic spaces constitutes the final feature in their maturation. During the period in which the enlargement of an individual space is actively going on, the margins of the main cavity consist of smooth delicate strands of nucleated protoplasm that resembles that of the trabeculæ between the large reticular spaces. These linear margins are interrupted here and there by openings into adjacent spaces. They tend, however, to form a continuous line that definitely marks off the space from the adjacent reticulum. As the space becomes more mature the membrane-like border becomes thicker until it reaches a state that will probably not admit of any further opening-up for the coalescence of additional spaces. Any further growth is thereafter limited to simple distention of the wall of the space with the consequent adjustment of its constituent cells. In its final form, the margin of the space roughly resembles an endothelial membrane. Immediately lining the space is a thin membrane with flattened nuclei, which is supported underneath by a thin coat of nucleated protoplasm that has the form of fibrous connective tissue. The former, judging only from its final appearance, could be designated as endothelium, thus making a distinction between it and the underlying tissue. In its histogenesis, however, it differs in no way from the rest of the wall and the difference that

exists later seems to be merely the result of its adaptation to the existing physical conditions. Its early behavior is entirely different from that of vascular endothelium. Therefore, if one uses the term endothelium for its designation it must be done with a considerable amount of reservation.

The earliest evidence of the formation of the periotic spaces occurs near the stapes, in the reticulum lying between the saccule and the fenestra vestibuli, where in embryos between 30 mm. and 40 mm. long it can be seen that its meshes are becoming irregular and its spaces are beginning to coalesce. This constitutes the rudiment of the vestibular cistern which makes its appearance before there is any trace of the scalae, but it is not until the fetus becomes about 50 mm. long that the cistern is definitely outlined and clearly differentiated from the adjoining reticulum. After the cistern the scala tympani is the next space to become established. It can be recognized as a moderate widening of the meshes of the reticulum in the region of the fenestra cochleae in fetuses 43 mm. long, the basal border of the first turn of the cochlear duct. The scala vestibuli, as can be seen in fetuses 50 mm. long, develops as an extension downward of the cistern along the apical border of the cochlear duct. Starting from these definite foci these three spaces spread into their destined territory absorbing as they go, by the process of coalescence, the enlarging reticular spaces of the invaded region. In fetuses 85 mm. long the two scalae extend downward along the cochlear duct to its last turn as two separate spaces which do not communicate with each other. When they reach the tip of the duct which occurs in fetuses about 130 mm., crown-rump length a free opening is developed between them, and this represents the helicotrema.

In dealing with the cistern and the scalae it becomes evident that they are not to be considered as insignificant accessories that merely fill in the waste intervals between the membranous labyrinth and the surrounding cartilage. On studying their development it becomes apparent that they have a morphological individuality in many respects

as definite as that of the ossicles themselves. They make their appearance at a definite time and at definite places, they spread in a definite manner, and eventually they attain a form and structure that are adapted to a definite function.

Demonstration by wax-plate models of human embryos showing the form and relations of these spaces at three periods in their development.

Discussion.

Dr. J. Gordon Wilson, Chicago, Ill., was pleased to have had the privilege of seeing this demonstration. Professor Streeter had for several years devoted much time to the study of the ear from the embryological point of view. He assured Dr. Streeter that this national Society of Otologists welcomed such a talk as he had given. They recognized the importance of such work as fundamental to the understanding of the specialty they practised. Many problems in connection with the ear had yet to be settled and it was by means of such laboratory work as that of Dr. Streeter's that the solution of many of these problems should come.

Dr. George L. Richards, Fall River, Mass., had witnessed some of Dr. Streeter's work in the Marine Biological Laboratory at Wood's Hole. He wished that Dr. Streeter had told something of his observations in connection with the ductus endolymphaticus. Perhaps at another time he would do so.

Dr. Streeter, in closing the discussion, mentioned one point as illustrating the importance of embryological investigations with regard to the ear, namely, that in all books on anatomy the organ of Corti is represented as resting on the basilar membrane with the membrana tectoria above. Since in the natural position in the body the spiral cochlea points obliquely downward like an inverted cone, it follows that the organ of Corti is suspended from the basilar membrane. It is therefore suggested that if in picturing the

cochlea the scala tympani were shown as above the cochlea duct and the scala vestibuli below it would more nearly approach the natural orientation. The organ of Corti should be inverted.

A MODIFIED RADICAL OPERATION FOR CHRONIC SUPPURATIVE OTITIS MEDIA BASED ON THIRTEEN CASES. LANTERN ILLUSTRATION OF PROCEDURE.

By HUGH B. BLACKWELL, M. D., New York City.

In performing this particular operation on the following thirteen cases, my purpose was (1) to stop the middle-ear discharge, and (2) to conserve or, if possible, to improve the hearing.

All of these operations were performed in the services of Dr. Robert Lewis at the New York Eye and Ear Infirmary and Dr. A. B. Duel at the Manhattan Eye, Ear and Throat Hospital.

Operation: The usual postaural incision is made, as in the Stacke operation. The soft parts anterior to this incision are elevated and retracted forward; the cortex is removed with a gouge and the sub-cortical cells with curets until the antrum is opened; the posterior bony canal wall is lowered and the antrum widened to its fullest possible extent. When the short process of the incus becomes visible, the external attic wall is removed by placing the back of the curet external to and in front of the incus and cureting from within outward. The bony canal wall is still further lowered until the facial ridge is reached, leaving only an epitympanic ring in its superior portion with a width of about 1-16 of an inch. In four instances I have removed this portion of the ring in the superior quadrant of the circle, leaving the membrana tympani and ossicles intact.

The granulations, polypi and cholesteatoma lying in the external and internal attic are removed by curetting internal or external to the incudal body, care being observed not to destroy the suspensory ligament of the malleus or its external lateral ligament. In curetting near the incus, great care must be taken not to disturb the ligament which binds

the extremity of its short process to the bone below and just in front of the external semicircular canal.

An L-shaped meatal flap is cut as in a radical operation, the cartilage removed, and the flap sutured to the temporal fascia. The mastoid wound and attic region are packed snugly, thereby furnishing support to the flap, and the

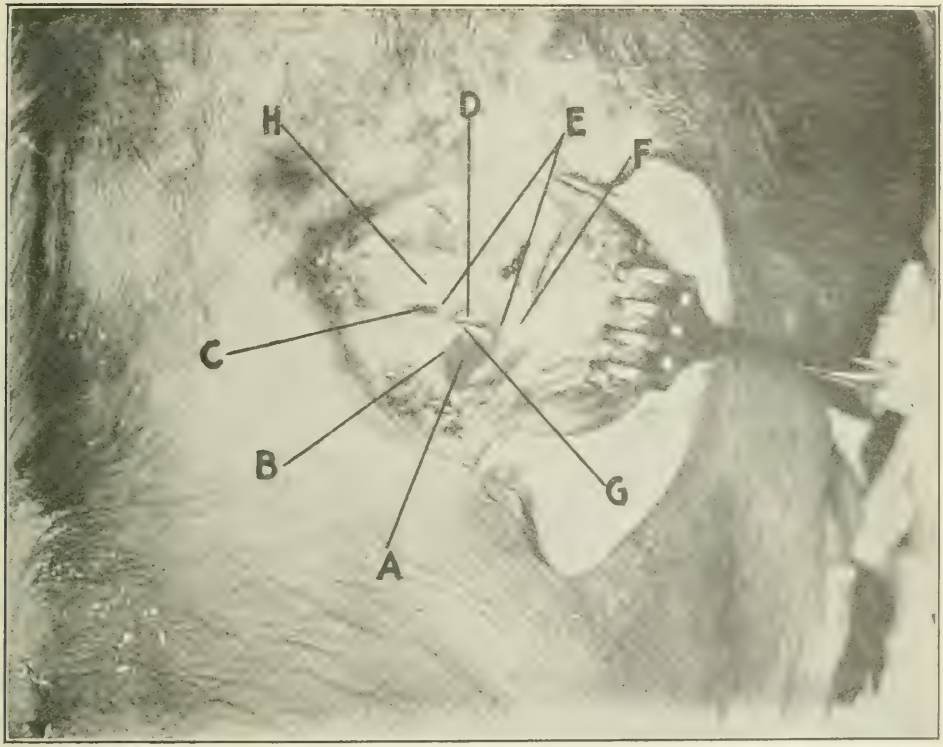

FIGURE I.—View of completed operation, with Epitympanic Ring intact, taken from behind, prior to closing posterior wound. Drum and Ossicles are left intact.
A—Membrana Tympani.
B—Facial Ridge.
C—External Semi-Circular Canal.
D—Malleo-Incudal Body.
E—Attic of the Middle Ear.
F—Plastic Meatal Flap sutured to Fascia of Temporal Muscle.
G—Epitympanic Ring.
H—Antrum.

posterior wound is sutured throughout. The drum and ossicles are, of course, not disturbed, but left in situ.

Case I. A sub-acute condition; history of seven weeks discharge. Operation three years and four months ago; large perisinus abscess, with perforation of the pre-mastoid lamina and necrosis of the adjacent posterior bony wall. The ear

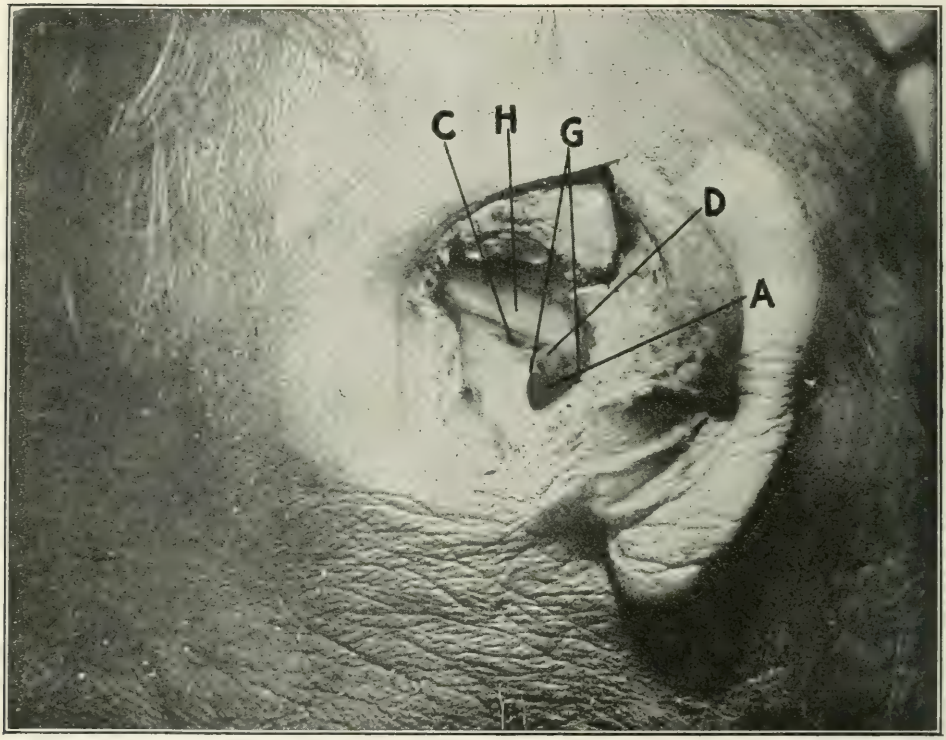

FIGURE II.—View of completed operation, where the Epitympanic Ring of bone has been removed in the superior quadrant. Drum and Ossicles are left intact
A—Membrana Tympani.
C—External Semi-Circular Canal.
D—Malleo-Incudal Body.
G—Epitympanic Ring of Bone has been removed between termination of lines.
H—Antrum.

has been dry ever since shortly after the operation. The incus was removed.

At present the patient hears an acumeter at six feet and a moderate whisper at six feet.

Case II. Ear had been discharging for two years. Operation was performed two years and nine months ago. Cholesteatoma was found in the antrum. Ear has been continuously dry ever since shortly after the operation.

Whisper heard at 18 inches, and watch only on contact, before the operation. The patient now hears an acumeter at one foot and a whisper at four feet.

Case III. Ear had been discharging for two years. Operation was performed two years and three months ago. The ear has been continuously dry since shortly after the operation.

Prior to the operation the patient heard a whisper at twenty feet. She now hears a whisper at four feet, and an acumeter at the same distance.

Case IV. Double o. m. p. c.; right ear had been discharging for one and a half years, and the left for six months. Double operation performed two years and four months ago. Both ears are dry and have been so continuously since shortly after the operation.

Hearing before operation: Right ear, acumeter at three inches and whisper at three inches. Hearing now: acumeter at two feet and whisper at eighteen feet.

Left ear: Before operation,—acumeter at twelve inches and whisper at one foot. Hearing now: acumeter at six inches and whisper at twenty feet.

Case V. Ear had been discharging for four months prior to operation, which was performed twenty-one months ago. A very large exostosis was present, springing from the posterior wall. Since operation, the ear has discharged intermittently. At present there is a very slight discharge from the tube, which is not perceptible to the patient.

At present, the patient perceives a whisper at five feet and an acumeter at four feet.

Case VI. Double o. m. p. c. The right ear had been discharging for six months and the left for two years. Double operation was performed simultaneously seventeen months ago. Both ears have been continuously dry ever since shortly afterward.

Hearing at present: right ear,—acumeter at twenty feet and whisper at twenty feet.

Left ear,—acumeter at fifteen feet and whisper at fifteen feet.

Case VII. Clinical diagnosis of tubercular otitis. The ear had been discharging for five months previous to operation. This was performed one year and four months ago. The ear is now dry, and has been so continuously, with the exception of a slight discharge which began three months ago and lasted for about three weeks. A perisinus abscess was found in this case and the sinus was accidentally opened during the operation.

An acumeter is now heard at two feet, and a whisper at eight feet.

Case VIII. Double o. m. p. c. Both ears had been running for eighteen years, following scarlet fever and diphtheria. Operation was performed a year ago. The left ear has been continuously dry since shortly after the operation. The right ear has been dry at times, but is discharging at present.

Hearing prior to operation: Acumeter,—right ear, three feet; left ear, six feet; whisper in both ears at six feet.

Patient now hears: Acumeter,—right ear, eight feet; left ear, two feet; whisper in both ears at eight feet.

Case IX. There had been a discharging ear for the past seventeen years. Operation was performed nine months ago. The ear has been dry at times, but is at present wet. The discharge is from the tube.

Hearing before operation: Left ear,—acumeter at two feet, and whisper at six feet.

The hearing since the operation is the same.

Case X. The ear had been discharging for ten years. Operation was performed eight months ago. Since then

there has been a continuous slight non-odorous discharge from the tube.

Before operation, an acumeter could be heard at ten feet, and a low whisper at ten feet.

At present an acumeter is heard at five feet, and a low whisper at five feet.

Case XI. Patient had a discharge for five years prior to admission to the hospital. Operation, eight months ago. (A previous operation had been performed a year before that, and the posterior wound had never healed.) Cholesteatoma was found in the antrum. The ear is now wet.

Before the operation, the patient heard the acumeter at ten feet, and a whisper at ten feet. Since the operation, patient hears the acumeter at six feet, and a whisper at four feet.

Case XII. Patient's ear had been discharging for fifteen years previous to admission to the hospital, following measles. Operation, seven months ago. The ear was dry until three months ago; since then there has been a slight discharge.

Hearing before operation: acumeter at three feet; whisper at six feet.

Hearing now: acumeter at seven feet; whisper at ten feet.

Case XIII. Patient had discharge from the ear for five weeks previous to admission to hospital. Operation was performed six months ago, and showed necrosis of the posterior bony canal wall and perforation of the pre-mastoid lamina. The ear is now dry and has been so for over four months.

Hearing before operation: Acumeter at twenty feet and whisper at twenty feet.

At present it is the same.

Summary.

These thirteen cases represent sixteen primary operations, for in three instances both ears were involved and a double operation was performed.

From the standpoint of duration of discharge, the cases may be arbitrarily divided into two groups.

1. Those in which the discharge had existed for five years or more previous to operation.

2. Those in which the ear had been discharging for less than five years.

In the first group there were six primary operations with the following results: Four of the ears are now wet, and have been more or less so continuously since the operation. The discharge is non-odorous, however, and is much less than before the operation. Two cases are intermittently wet and dry.

The hearing results in these six cases show that in three instances the hearing for the whisper was improved; in one case the hearing remained the same, and in two of the patients there was a slight depreciation in whisper perception.

In the second group of cases, or those having had a discharge of less than five years, excluding the two sub-acute cases, there were eight ears coming under this classification. Six of these ears have remained continuously dry since operation, and two intermittently so.

Three of these ears show improvement in hearing as compared with tests made before the operation.

In the grand total of sixteen operations performed, eight resulted in dry ears which have been continuously dry since convalescence from operation; and four have discharged intermittently since operation, and four continuously. One of the intermittent cases is at present dry.

The longest duration of dryness since operation, in the eleven chronic cases reported, has been two years and eight months; and the shortest has been six months.

With one exception, all the patients were adults.

Two cases were complicated by the presence of well-marked perisinus abscess. Six had marked constitutional symptoms, such as severe headache, dizziness prior to the operation, etc., and since the operation these symptoms have been relieved.

In two instances, cholesteatoma was found in the mastoid: one of these cases resulted in a dry ear and has remained dry for over two years.

In none of the thirteen cases did the patients think the hearing had become impaired since the operation. In this connection, it is interesting to note that in case XIII, the hearing was almost normal before the operation; it is the same at present, showing that, in this case at least, the procedure had no ill effect upon the hearing.

All the cases recovered.

In the nine healed and dry ears, it is interesting to observe the amount of repair which has taken place in the tympanic membrane. Six of these cases now show intact drums, despite the large perforations which formerly existed. In three of these cases, half of the drum membrane was missing. The remaining five cases show large dry, unhealed perforations.

Another interesting feature is the development of a secondary tympanic membrane, which in all but one of these cases has grown across the attic region in the process of healing, completely closing the attic off from the mastoid cavity.

In performing the dressing it is necessary to pack the attic region snugly until it becomes well dermatized; otherwise it will soon become filled with a thick plug of granulations which, if infected, will be apt to discharge copiously, reinfect the middle ear, and prevent its proper aëration. It is probable that the discharge which occurred in two of the wet cases in this series, was caused by the failure to properly appreciate the importance of this point.

It will be seen that the best results were obtained in the second group of cases,—namely, those with a history of discharge lasting less than five years. The procedure seems especially applicable in this class of cases, and more particularly so in those chronic cases in which there is good hearing.

I believe that this operation is indicated in cases of aural discharge of several months' standing, which have resisted treatment, and where the patient is threatened with the pos-

sibility of a long-continued suppuration. I do not think that the presence of a large perforation, or the absence of half the tympanic membrane is a contraindication to the operation, —as demonstrated by some of these cases.

The important element to be considered in cases of subacute and chronic otitis media, in the absence of constitutional symptoms, is, of course, the hearing. If this be good, and the discharge under five years' duration, I believe this operation to be especially indicated.

In cases of exostosis of the canal associated with o. m. p. c., and in perforation of the pre-mastoid lamina associated with necrosis of the posterior bony canal wall, it should be the operation of choice.

Another point in favor of this procedure is that the danger of causing an injury to the facial nerve is negligible.

Conclusions.

This operation is not presented as one that would entirely replace the Stacke procedure; the latter operation has its own distinct field of usefulness. It is very difficult to compare the results obtained from a radical operation with those obtained from a modified radical operation, save in a very general way, since of course no one could say what the results would have been in any one of these cases had a radical operation been performed.

I am convinced, however, that the functional results obtained in these cases compare very favorably with the best which follow the Stacke operation; and that in the future, as we learn better how to select cases for this modified radical operation it will yield even better functional results as well as a dry ear.

ROENTGEN EXAMINATION OF THE MASTOID.

By FREDERICK M. LAW, M. D., New York, N. Y.

It is interesting to note the increasing interest of the otologist in the value of the Roentgen ray as an aid in the diagnosis of mastoiditis; and it is a most valuable aid but only one of a number of laboratory tests which help us to arrive at a definite conclusion.

A diagnosis can sometimes be made from the plate alone but very seldom. It is necessary for the Roentgenologist to have all the clinical data as well as the history and, after carefully examining the plates, to compare the findings with the clinical and other laboratory evidence. Then preferably to have a consultation with the surgeon before arriving at a positive diagnosis.

The X-ray is not infallible and must be used with judgment and caution. A single glance at a plate, no matter how good a plate it may be, is apt to be misleading. The image must be considered from every point of view and the slightest divergence from the normal correlated with the evidence from the other laboratory tests and the clinical evidence.

The crux of the situation is: First, know the diagnostic ability of the Roentgenologist; second, get good plates; third, get together in a consultation over the plates. Do not be afraid to talk the case over with the Roentgenologist and discuss all the doubtful points, for he should possess sufficient knowledge of otology to be able to discuss the case in a rational manner.

Don't send the case as a last resort or as a test of the diagnostic ability of the Roentgenologist. Use the ray as you would use the evidence of the microscope or a blood test or any of the various laboratory examinations upon which you now depend so much.

One great trouble is this, the surgeon may see a number of plates of simple positive cases and then consider himself

capable of interpreting his own plates. This may be all right for some men who are used to working with a certain Roentgenologist and become accustomed to his technique and thus learn some of the faults which are liable to occur in the making of a plate, but with the majority of surgeons, these conditions do not exist and an error in interpretation might be the cause of serious embarrassment and then the X-ray is condemned.

Now, how does the X-ray help? It adds one more link to the chain of evidence in the case of a simple acute mastoid by showing the extent of involvement of the cells and the condition of the cell partitions, thus assisting in determining the advisability for operation.

In the chronic cases, it shows the anatomy of the mastoid, the amount of sclerosis and the extent of involvement of the remaining cells; also the presence or absence of bone softening.

It is in the case of the chronic discharging ear that the patient usually refuses an operation, while the surgeon knows that an operation is advisable to preserve hearing and to stop the discharge. Here the X-ray furnishes a visable evidence of the extent of involvement as compared with the normal side, or in case both sides are involved, with the image of a normal case, and, by explaining the difference, the patient is made to realize from the evidence of his own eyes, that a serious change has occurred, and is more readily convinced of the necessity for operation. Then there is the case of mastoid tenderness associated with furunculosis in the canal. The canal can not be examined, the drum can not be seen, and although one is fairly certain that there is no definite mastoid involvement, the evidence furnished by the X-ray clears up the diagnosis.

There is the case which discharges freely, has little tenderness, little bulging, but which persists for a while, then clears up for a time to again discharge. The X-ray, by showing the anatomy of the mastoid, will explain the condition; as a mastoid possessing large pneumatic cells is more liable to discharge its contents freely; while one of small cells in

the superior region is apt to become clogged and allow the pus to accumulate; thus stopping the flow until pressure ensues which forces the opening and the ear again begins to discharge.

By knowing the structure of the mastoid one can watch the case with complete knowledge of the process going on and determine the time or necessity for operation with more assurance. If necessary, one examination can be followed by another and the progress of the case watched with certainty. It must be thoroughly understood that the Roentgenogram is not a photograph but simply a registration of certain shadows cast on a photographic plate by the X-rays passing through structures of different densities. The degree of density of the part governing the amount of the actinic ray which reaches the plate, thus reducing the silver in the emulsion and producing varying amounts of darkening or shadow formation.

The mastoid process is a collection of pneumatic areas, separated by bony partitions. Being pneumatic they allow the maximum amount of the rays to penetrate to the plate reducing the silver and making a black spot on the plate. The bony partitions, offering considerable resistance to the rays prevent them from reaching the plate and produce white lines. Thus the shadow of the normal mastoid is registered on the plate as a honeycombed structure of black spots surrounded by white lines; the size of the black spots varying according to whether the mastoid consists of large or small cells.

Knowing that the normal mastoid offers practically no obstruction to the ray, we can readily see that if the cells contain any foreign material, there would be some obstruction; less ray would reach the plate, causing a difference in the degree of the shadow or shade produced on the plate, corresponding to the areas of the cells.

This may vary from a slight lightening of the shadow to complete obliteration of the outlines of the cells. The degree of mastoiditis or amount of pus depending on the clearness of the outlines of the bony walls.

If the mastoid is full of dense creamy pus there is sufficient obstruction to the ray to entirely obstruct the cells and bony partitions, thus producing a large white blurring in the mastoid region.

If the process is a chronic one and has gone to the extent of sclerosis the cells are obliterated and replaced by bone which entirely obstructs the ray, thus producing a shadow corresponding to the shadow cast by the surrounding bone of the skull. The sclerosed region showing a bony texture which merges into the bone of the skull, thus differentiating from the dirty white blurr of the pus filled cellular structure.

Now if the process has reached the point of necrosis either in the cellular structure or as a cholesteatoma, the bone being actually destroyed in a particular spot, the ray penetrates this area readily and we have a dark shadow in the midst of the white blurr or in the solid bone. This spot representing absorption of bone may vary from the simple breaking down of the partitions between adjacent cells to the destruction of large areas.

The question might be asked how can one distinguish the difference between the shadow cast by bone softening and a large cell?

The answer is by exclusion.

The structure of the mastoids of both sides are as a rule similar. Where there is a large cell on one side there will be a corresponding large cell on the other. This occurs so frequently that we can consider the two mastoids alike in structure.

Now if we find a dark area on the diseased side and no corresponding area on the other we can, together with the history and clinical findings, safely say this is a spot of softened bone. If we do find a dark spot on the normal side, we must consider the character of the one on the diseased side. The outline will be hazy and indistinct while that on the normal side will be clear and sharply defined. In the event of the involvement of both sides the question will be a difficult one to decide, as there is no room for comparison. Here the surgeon must be guided by the results of the other

examinations while considering the facts of the known extensive involvement of the cells from the X-ray evidence.

There are many difficulties in the interpretation of the plates which I will not take up your time to describe, but which will practically disappear if you consult with the Roentgenologist who makes the plates.

Discussion.

Dr. George L. Richards, Fall River, Mass., was surprised that no one had mentioned taking an anteroposterior view, from which a good deal of information might be obtained, as might be observed from some plates he had on exhibition.

Dr. J. M. Ingersoll, Cleveland, Ohio, emphasizes the value of stereoscopic X-ray plates, which give positive information in regard to the operative field. If, instead of depending upon the roentgenologist for the interpretation of the plates, the otologist would study them more carefully, especially the stereoscopic plates they would obtain much more definite information from the plates. The operator would then go into the operating room with a very definite mental picture of the operative field. By studying the plates before operating and then again after operating one can easily acquire great skill in interpreting them. If the plates are reversed in the stereoscope then one is able to look at the temporal bone from the inside as well as the outside, and in this way can gain more information, particularly in regard to the position of the sinus. By careful study of the stereoscopic plates one may go into the operating room knowing almost exactly what must be done. It is possible to locate the sinus accurately, to determine whether it is near the cortex, or deep down in the mastoid bone, and to know definitely whether all of the mastoid is infected or only portions of it. In a number of cases brain abscesses have been definitely located in the stereoscopic radiographs, and it will probably be possible to locate them more frequently and more definitely as our skill in interpreting the plates increases.

Dr. E. B. Dench, New York City, agreed with the other speakers as to the importance of the X-ray as an aid to diagnosis, but he did not believe anyone would make the diagnosis and operate on this evidence alone. It must be taken in conjunction with physical signs and symptoms, with laboratory findings, and with the otoscopic diagnosis. The X-ray plate was only one link in the chain of evidence which leads to a definite conclusion. He recalled, in this connection, the case of a woman, 70 years of age, with a bad heart, in which a mastoid operation would probably have proved fatal. If he had taken the X-ray plate alone he would have operated. She recovered without operation. In his experience in two hospitals, the stereoscopic plates had not been quite as satisfactory as the others.

Dr. Emil Amberg, Detroit, Mich., thought Dr. Ingersoll's suggestion pointed the way to more accurate data. Dr. Law's pictures of cases in which cells were left which should have been eradicated, are very instructive. He had gotten least help from the X-ray pictures in cases of sclerosed mastoids. In these cases the clinical data are especially important.

Dr. Ralph Butler, Philadelphia, Pa., cited a case in which there was a septic temperature and high leucocyte count, no mastoid symptoms, nothing in the drum-head. X-ray gave a shadow, apparently in the mastoid. He performed an exploratory operation on the left mastoid, which was found to be normal, but a large clot was found in the lateral sinus.

Dr. Law, in closing the discussion, said no doubt stereoscopic plates were more valuable from a pictorial point of view, but practically just as much could be learned from single plate. He had tried the anteroposterior position, and also the vertical, but in either case one looks through the largest diameter of the mastoid and would therefore get a darker shadow and the mastoid process would be too far

from the plate. There was danger, in making so many exposures, of the patient losing the hair. There was a distinct and definite difference between sclerosis and pus. There was no difference between the appearance of a sclerotic mastoid and the bony wall of the skull, whereas, if there were pus in the cellular structure the X-ray would show the outline of the mastoid. This would be lost as soon as the mastoid became sclerotic. A large pneumatic mastoid with a little inflammation would give a shadow. All these points must be considered. Any pus in the antrum would show in the plate, but one must consider the size of the cells and the angle at which the plate was made.

Answering a question by Dr. Pierce as to the position of the head, Dr. Law said the patient lies on a table with the mastoid resting on a raised platform parallel with the table. The tube is placed over the opposite mastoid and tilted 15 degrees forward towards the face and 15 degrees downward toward the feet. This angle of the ray throws the opposite mastoid out of line, so as not to superimpose upon the mastoid being examined.

AN INTERESTING CASE OF STREPTOCOCCUS CAPSULATUS, MASTOIDITIS WITH UNUSUAL SYMPTOMS.

By T. LAURANCE SAUNDERS, M. D., New York, N. Y.

The following case occurred at the New York Eye and Ear Infirmary on the service of Dr. Gorham Bacon, to whom I wish to express my appreciation for the privilege of reporting it to you.

William M., a light colored Negro, aged 28, was first seen by me during my section teaching at the College of Physicians and Surgeons, February 12th, 1916. He had a running right ear of about four days duration, accompanied by a moderate amount of pain and slight tenderness over the antrum and tip. The drum was pale pink, slight if any bulging, and the discharge was scant, issuing from a perforation in the anterior inferior quadrant. The patient's expression was anxious and he exhibited a degree of prostration seemingly out of proportion to his local symptoms. On this account he was immediately referred to the New York Eye and Ear Infirmary for incision of the membrana tympani. He was admitted to the infirmary February 14, 1916, and a myringotomy under nitrous oxide anesthesia was performed. Bacteriological examination of the aural discharge showed a streptococcus capsulatus infection. X-ray showed a hazy mastoid on the right side, cell partitions not broken down, left mastoid clear. His temperature ranged from 98.6° to 100.4°. Five days after admission antrum tenderness still persisted, and the discharge was moderate and the patient complained of some pain. On account of the nature of the infection, persistence of the mastoid tenderness, and the non-improvement in the patient's general condition, I asked one of our assistant surgeons to perform the mastoid operation. Upon removing the cortex free pus was immediately demonstrated. The

cells of the mastoid were filled with pus and granulation but the cell partitions were not broken down. In cleaning out the cells near the tip the lower part of the sinus was accidently injured with a curet. This was allowed to bleed freely and a piece of iodoform gauze placed over the opening. The rest of the cavity was packed with plain and iodoform gauze. After operation the temperature ranged from 99° to 101.2°, the patient was fairly comfortable and complained of slight pain in the region of the wound. On the fifth day after operation the packing over the sinus was removed, with no bleeding. Soon afterward the temperature rose from 100.2° to 103.4°, falling the next morning to 100.8° and rising again in eight hours to 103.8°. This rise of temperature was accompanied by frontal headache and a throbbing pain in the region of the wound. Previous to this the patient had complained of frequent cough with profuse and occasionally blood stained expectoration. *The wound looked well.* On account of the wounding of the sinus we were apprehensive of a sinus thrombosis. Careful questioning elicited the fact that the patient had had some chilly sensations the night previous to the rise in temperature. The blood count showed—7,200 whites and 66% polynuclears, the following day 11,300 whites and 77% polynuclears. A blood culture was taken which was subsequently reported negative. The patient did not look septic and did not have the appearance of a sinus case. Careful physical examination at this time revealed the presence of a macular rash over the chest and abdomen, enlarged epitrochlear glands, a suspicious sore in the mouth and a scar on the prepuce. Wassermann 4+. Noguchi 4+. Gonorrheal fixation +. We decided to wait. In the succeeding days the temperature ranged from 98.6° to 103.8°. Two more blood cultures were taken and both negative. Urine negative, save for a trace of albumen and a few pus cells probably due to his gonorrhea. Eye grounds negative. Chest showed signs of a chronic bronchitis. No signs of tuberculosis. Sputum negative upon repeated examinations. From time to time the patient complained of a sore throat and frontal headache. 606 was not

available and he was given one grain of salicylate of mercury every other day. On March 3, 13 days after his first operation his temperature rose to 105°, no chill but headache. Although there were no other signs of sinus thrombosis, on account of its possible cause in the wounding of the sinus and on account of the failure in the patient's general condition and because physical examination was otherwise negative, it was decided to explore the sinus.

This was done on March 14, two weeks after the first operation. The sinus was uncovered for two inches. It looked healthy save for a few granulations over the site of the previous wound. It was opened. Free bleeding occurred from both ends. No signs of a clot were seen and the interior of the sinus was clean and healthy. The vein was not ligated. The second day after operation the temperature rose to 105.4° (blood culture negative) falling to 99° to rise to 102.6° the third day after operation. From then on the patient ran a temperature from 98°-99.4°. On March 23 his temperature rose to 103.8° from no apparent cause and then fell. He made a steady recovery. When last seen by me his mastoid wound had healed perfectly, the canal was dry and the landmarks of the drum visible. He refuses further specific treatment, saying he had gained fifteen pounds and that is enough for him.

It seems to me that the case emphasizes an interesting and important problem which hitherto has not been sufficiently considered, namely, that of acute mastoiditis in an active syphilitic. What was the cause of this man's temperature? Did he have a sinus thrombosis, or was the operative trauma plus the active syphilitic process sufficient to account for his condition?

Discussion.

Dr. E. B. Dench, New York City, asked the essayist if he had considered the question of rash, and if it might not be a streptococcic rash. He did not remember having heard of a case of syphilis, except of the primary stage, causing the two sets of symptoms. The case looked to him like one of

parietal clot, with bacteria insufficient to give a culture but enough to produce the symptoms. In the first place, the blood culture was not always positive. There might be a negative culture in a case of sinus thrombosis with characteristic symptoms. He had exposed the sinus in such a case. In other words, when the blood was taken close to the focus of infection there might be a positive culture; if taken from a vein there might be a negative culture.

Dr. Saunders, in closing the discussion, said, with reference to whether the rash was streptococcic or syphilitic, he did not see how that could be determined, except for the fact that there was a positive Wassermann reaction. He had had one case of syphilis with a temperature of 103 degrees, but never as high as in the case reported.

THE WIRE GAUZE BRAIN DRAIN.

By HARRIS PEYTON MOSHER, M. D., Boston, Mass.

One of the difficult things in the treatment of a brain abscess is to find a drain that does not soon clog and cease to be of use. I suspect that many operators shift about hoping that the last thing which they try is to solve the problem. A year ago this June while working in France with the First Harvard Unit, as a member of the British Army Medical Corps, I found that the surgeons were using a drainage tube which they said gave good results. I tried it once in France and have used it twice since my return. The first case, an extensive gunshot wound of the left frontal lobe, was transferred to England at the end of a week and a half apparently well on the road to recovery. Of the two cases in which I used the drain in this country, one a cerebellar abscess, recovered, and the other, a case of multiple abscess of the temporosphenoidal lobe, (three abscesses in all were found), died at the end of six weeks.

The British Army brain drain is a metal tube closely studded with perforations. It is kept filled with glycerine and the gauze over it also is saturated with glycerine. The object of this is to soften the necrotic brain tissue and to keep the pus liquid so that both the cast off brain substance and pus can make their way into the tube. Each day the contents of the drain are removed with a small curet. The first drain which I used was extemporized from a sheet of perforated zinc such as surgeons make emergency splints of. In this country I had the drains made of copper wire gauze of a fairly wide mesh. In the case which lived six weeks and had three abscesses, there was a chance to experiment with different forms and sizes of the wire drain, so I feel that I have a pretty accurate knowledge of some of the useful shapes and sizes. These the instrument maker now supplies. In emergency work, however, it is easy to cut a drain from a piece of copper gauze and to fashion it as one wishes.

I am sorry that I do not know who originated the perforated metal drain nor who is responsible for the use of glycerine in connection with it. The report about camp was that this form of drainage had lowered the death rate from brain wounds in the present war markedly. In the rush of army surgery the figures could not be obtained. Undoubtedly some day they will be published.

The attitude which the army surgeon took toward brain injuries interested me, especially as it had a certain bearing on the brain work of the aurist. The wound in the dura was enlarged as little as possible for fear of disturbing any walling off which had taken place between the dura and the pia. The cavity in the brain was probed reluctantly. If there was not much destruction of cerebral substance no metal drain was inserted. The skin flap, which was generally oval, was turned back into place and a cigarette drain of gauze wrapped in rubber tissue run in and out beneath the base of the flap. If the temperature remained normal and no intracranial symptoms developed nothing further was done except to remove the drain after three or four days. If, however, temperature did set in and intracranial symptoms developed, especially choked disk, the wound was opened up and the metal drain placed in the cavity caused by the injury. As I said before, the drain was filled with glycerine and the dressing over it was saturated with it.

In the case which I treated in this manner in France the glycerine was used daily, and Dr. Lougee used it daily in the cerebellar abscess which I saw in consultation with him after my return home. It was used for a week in the case of multiple abscess of the temporosphenoidal lobe, but was discontinued because I became afraid that the pressure of glycerine might rupture a weak spot in the abscess capsule.

Now to return to the drain itself. It is hard to keep the ordinary brain drain in place. The wire drain, however, catches in the granulations at the edge of the skin wound and holds in place almost too well. The copper gauze allows the operator to bend the drain as he pleases. For insertion the drain is closed by a plunger. The natural shape of the drain is a

cone. If the drain is kept clean it serves in a measure the purpose of an encephaloscope, as the brain substance or the wall of the abscess can be seen to a certain extent through the meshes of the wire gauze. In the case where there were three abscesses in the temporosphenoidal lobe the second abscess was located by pus welling up through the base of the front wall of the cone. Finally, if brain hernia threatens counter pressure can be made against the protruding mass by slitting the side of the cone and turning the base back to make a collar. The wire drain then is a pliable instrument. The combined use of this drain and glycerine gives a brain drain which seems to drain. My experience with it is limited to three cases. It is a safe rule to praise slowly and to shun enthusiasm, nevertheless in speaking of this method of draining a brain abscess I am strongly inclined to break the rule.

Discussion.

Dr. John F. Barnhill, Indianapolis, Ind., said it would be one's first thought that the wire gauze drain would hold too firmly, and that if it needed to be removed it might lacerate the edges of the brain substance. In such cases, how could it be replaced into wound if necessary?

Dr. Mosher, in closing the discussion, said there might be some difficulty in removing the drain if it were left in position for a long time. That had occurred in the case of cerebellar abscess mentioned in this paper. In the case with the three abscesses, in which the drain was put in and taken out repeatedly, it was easy to remove it.

REPORT OF THREE CASES OF BRAIN ABSCESS.

By O. A. M. McKIMMIE, M. D., Washington, D. C.

The following cases are reported, not because brain abscess is such a rare condition in the work of the otologist, but because it has been my experience that each case is different from every other and presents some feature of interest.

Case 1. E. E., age 19 years, was brought to the hospital in a rolling-chair as she was too weak to walk. Left suppurative otitis had existed since she was two years old, intermittent in character, and at the time admitted to the hospital she had very little discharge.

History of severe headache for about two months, all over head, but specially severe in occipital region.

She was somnolent but easily aroused and while showing slow cerebration was rational and answered all questions intelligently. She had a paresis of the left external rectus and nystagmic movements *confined to the left eye and present only when looking toward the left.*

Caloric tests of labyrinths with cold water showed normal nystagmus: no enduring nystagmus.

Diagnosis of brain abscess in temporosphenoidal lobe.

Nystagmic movements of left eye were interpreted as intention tremor of a partially paralyzed muscle, and cerebellar abscess was ruled out because the cold water test did not produce enduring nystagmus, the conclusion being that if cerebellar abscess existed it would have destroyed the normal cerebellar control of the labyrinth.

She was admitted to the hospital about 8 P. M., and operated on the following day at 3 P. M., being at that time in a semi-comatose state.

The usual radical operation revealed an exenterated mastoid filled with cholesteatoma, tegmen tympani and antri for the most part missing, and some pachymeningitis. Repeated exploration of the temporosphenoidal lobe in all directions failed to find pus.

The patient died suddenly within an hour of being returned to her bed from the operating room.

Postmortem examination revealed a ruptured chronic abscess, about the size of a medium sized walnut in the extreme outer and upper part of the left hemisphere of the cerebellum.

Case 2. Major I., age 56 years: history of suppurative otitis since two years of age.

At times ear would cease to discharge for long periods.

When seen at his home three days before admission to the hospital he gave a history of having been in bed for five weeks with what was apparently a prolonged grippe attack, although the temperature was of a mildly septic type.

I was asked to see him because he was not responding to medical treatment and his attendants thought the ear might have something to do with his condition.

Examination at this time revealed the middle ear filled with cholesteatoma, very foul but not accompanied with much discharge, and a totally absent membrana tympani.

He was very weak but able to get out of bed and to submit to such turning tests as could be carried out in a private house. Both labyrinths responded normally.

He was perfectly rational but his family said that for three or four months he had been extremely forgetful and frequently was careless about business matters concerning which he had previously been very careful.

I advised a radical mastoid operation and asked that a careful temperature, pulse and respiration chart be kept and that I be kept informed as to his condition.

I heard nothing further for three days, when I was called on the telephone and told that he was unconscious. I ordered him removed to the hospital and did a radical mastoid operation, finding again, as in the first case an exenterated mastoid, filled with cholesteatoma and a necrotic tegmen antri. Exploration of the temporosphenoidal lobe through an area of necrotic dura evacuated about an ounce of pus. When the reaction from the anesthesia was complete he began to have muscular contraction of all the extremities, followed by

general convulsions, and became so violent that he had to be put in a straight-jacket and strapped to the bed.

This condition lasted for nearly twenty-four hours, notwithstanding hypodermics of hyoscin. He then became quiet and rational and although extremely weak and exhausted recognized his family and myself and was able to answer questions. He grew gradually weaker and died within 64 hours of the time of operation.

Temperature on admission 97.6°.

Post operative rise 100.4°, dropping to 99° twenty-four hours later.

Temperature at time of death 104.4°.

Postmortem examination revealed, in addition to the cavity which had been evacuated, a very extensive basal meningitis and a greenish gray infiltration of the gray matter over the base of the entire temporosphenoidal lobe. This condition was undoubtedly chronic and it seems strange that he had not shown more evidence of meningitis.

Case 3. W. M., 8 years old, brought into hospital because of persistently recurring headaches and pain over both mastoids. Had had suppurative otitis for about 5 years on both sides; not much discharge at time of admission. History of long periods during which ears remained dry. There was also a history of injury to the head about 2 years previously and his parents were inclined to attribute his headaches and extreme irritability to this injury. He showed a very interesting condition while under observation before operation. On alternate days his temperature would be nearly normal and he would have no headache, mastoid or other pain. On other days his temperature would be elevated, his mastoid exquisitely tender and the head extremely sensitive to pressure at any point. In fact, there was scarcely any part of the body which was not painful when touched. On those days temperature and pain could be controlled by quinine.

Having shortly before this had two cases of undoubted malarial mastoidalgia, both Dr. R. R. Walker, who was associated with me in the care of this patient, and myself were

inclined to consider this a possible malarial case, especially as the patient had previously had malaria and lived in a section where malaria was prevalent. We were, however, because of the temperature range compelled to consider brain abscess and sinus thrombosis. The puzzling feature of the case was the fact that on alternate days he had no pain and seemed better. After keeping him under observation for about two weeks and realizing that he was getting no better, we determined to open the left mastoid and explore the brain on that side.

We selected this side solely on the ground that when mastoid pain was present the left side was the more painful of the two to pressure.

Operation revealed a chronic mastoiditis, necrosis of the tegmen tympani and an area of necrotic dura through which a temporosphenoidal abscess was easily evacuated.

He was returned to bed in good condition and for two days seemed better; then his temperature range indicated a lateral sinus thrombosis.

Three days after the first operation he was taken again to the operating room and the lateral sinus exposed, opened and thoroughly curetted. There was no return from bulbar end and although the clot was thoroughly removed as far as the torcular there was no free bleeding.

Before there was time to attempt a jugular resection pulse and respiration ceased and so far as one could tell the patient was dead.

In moving him from the operating table to the stretcher he emitted a slight moan when his legs were moved which was the first sign of life for several minutes.

All kinds of stimulation, including camphor injections strychnia and oxygen were used. Hypodermo-clysis and intravenous injections of salt solution were given and every possible effort made to restore him. After a night of continuous effort of two resident physicians, Dr. Walker and myself, we were rewarded by seeing him conscious and in fair condition as to circulation and respiration. He lived about two weeks, growing gradually weaker and died from

general exhaustion. For about ten days before his demise he refused nearly all nourishment and was kept alive by nutrient enemata and inunctions of combined nutrient oils.

Two days before his death, while dressing his brain cavity there was a sudden gush of pus from a second abscess which had not been found at the original operation.

Resumé. Temperature on admission 100.6°; pulse 128.

Temperature range for succeeding six days from normal to 104°, usually between 99° and 100°; next seven days from normal to 101°, once reaching 104°; next three days from 101° to 104°.

First operation 16th day after admission; second operation 19 days after admission. Between operations temperature from 99.6° to 104.8°, dropping to 97° and then mounting to 104.8°.

Before operation Widal and malaria tests were negative. Leucocyte count on the day after admission 9,800. Several leucocyte counts made before the first operation always showed from 15,000 to 16,000, but on the night before the first operation there was a sudden jump to 32,400. Blood culture before second operation was negative.

The patient died 31 days after his admission.

Points of Interest.

Case 1. Paralysis of the external rectus is occasionally found as the result of a localized meningitis in cases of mastoid disease, but unilateral nystagmus is, in my personal experience, uncommon. This patient's inability to stand or walk was due, in my opinion, more to her exhaustion than to the cerebellar abscess.

Notwithstanding the patient's complaint that pain was most severe over the occipital region I felt justified in the diagnosis of cerebral rather than cerebellar abscess because of the absence of prolonged nystagmus.

Case 2. The only point of interest in this case, other than the fact that with so extensive brain and meningeal involvement a man could live so long a time, is the fact that relief of brain pressure by evacuation of the abscess resulted in

such generalized convulsions, lasting about 24 hours and then disappearing.

Case 3. This patient's temperature, alternating days with pain and without pain, pulse, apparent control of symptoms by quinine, the existence of two separate foci of pus in the brain and the co-existence of lateral sinus thrombosis, formed a clinical picture extremely interesting and difficult of interpretation, except by postmortem examination, which I could not obtain in this case.

Discussion.

Dr. E. B. Dench, New York City, said aphasia is a pretty certain and constant sign of left-sided temporosphenoidal abscess. In the absence of aphasia he would go into the cerebellum. In the case of a normal labyrinth one would not expect to find real nystagmus to the corresponding side.

Dr. John F. Barnhill, Indianapolis, Ind., asked if there is any foundation for the statement that in left-sided persons the speech centre is on the opposite side. Would it not be necessary to inquire into this matter?

Dr. John B. Rae, New York City, called attention to the fact that nystagmus of vestibular origin tends to diminish from day to day, while that of cerebellar origin tends to increase from day to day.

Dr. McKimmie, in closing the discussion, reiterated that in the third case he went into the left side and found two abscesses. There was no aphasia until after the operation. It was then not real aphasia, but an unwillingness to talk. There was no true nystagmus, but a muscular tremor confined to the left eye when the patient looked to the side of the paralyzed muscle. As he got a normal reaction to cold water he concluded the patient did not have cerebellar abscess.

STANDARDS IN TEACHING SPEECH AND LIP-READING TO THE DEAF.

By PERCIVAL HALL, Litt. D., Washington, D. C.

In discussing any question concerning the teaching of speech and lip-reading to deaf children, it is well to understand at the start that the oral method or speech method of instruction is by no means a new one. It is no 20th century miracle; in fact, no miracle at all, but a steady growth from study and practice. For a hundred and fifty years deaf children in various countries of Europe have been taught to speak and to read the lips, and during that period thousands have received their entire education by means of written and spoken language.

The first public school for deaf children in the United States was established by Dr. Thomas Hopkins Gallaudet in Hartford in 1817. Gallaudet had been practically refused an opportunity to learn the English methods of instruction in 1815 and so obtained his knowledge of teaching the deaf at the National School at Paris during the following year. While the English methods employed oral teaching largely, such methods had been tried and given up in the National School, so that Gallaudet brought to the United States a method of instruction based almost entirely on the use of writing, the manual alphabet, and the language of signs.

After the opening of the Hartford school, a number of similar schools were started in various states in rather rapid succession. Manual methods were largely used, though efforts were made in the teaching of speech even at this early period in the history of the education of the deaf in the United States, notably in the New York Institution. Up to about fifty years ago, however, it is true that our schools did not do much toward giving deaf children an education by means of speech and writing alone. It is only fair to say, however, in passing, that as far as the actual mental training

of the child was concerned, it is doubtful if better educational results have ever been obtained anywhere than were to be found in the early schools of this country—presided over as they were by able men, seconded by well-educated and enthusiastic teachers.

From the very beginning of instruction of the deaf in this country, there was interest, both among teachers and parents, in the matter of speech teaching, and a number of American educators investigated the European oral schools between the years 1845 and 1865. The Clarke Oral School for the deaf in Northampton, Mass., was opened in 1867. A conference of principals of American schools for the deaf was called by Dr. E. M. Gallaudet at Washington in 1868. Dr. Gallaudet had visited, just previously, practically every school in Europe, and at this conference took the stand that every deaf child should have the opportunity to learn to speak. All of these events started a powerful movement in this country for the instruction of deaf children in speech and by means of speech, and since that time, through the efforts of various individuals and of associations of teachers and of parents, the amount of work done in our schools for the deaf by means of the oral method has steadily increased. In fact, the time has come when it may be asked if parents and school boards have not insisted upon overdoing in this direction, and even countenanced the teaching of poor speech at the sacrifice of the mental advancement of deaf children. In the minds of educated deaf people of this country, the statement made at Staunton, Virginia, two years ago, by one of our ablest educators of the deaf, Dr. Caroline Yale of the Clarke Oral School, that we want now not *more* speech but *better* speech in our schools for the deaf, is unquestionably correct. This belief, I am sure, is also held by a large majority of the educators of deaf children, so I am particularly glad to have an opportunity today to speak on the subject of standards in speech and lip-reading for the deaf.

In discussing the question of standards in speech teaching, I would like to call attention to the fact that our deaf pupils may be classified in various ways. In the first place, they

may be divided according to the amount of hearing which they have retained. This amount may, in general, be said to vary from absolutely no hearing at all to any amount which is just too little to allow the deaf person to be educated by ordinary means in the public schools. The possession of a considerable amount of hearing by many deaf children in our special schools is of tremendous value in their learning to speak and even to read the lips.

The deaf may also be classified upon another basis, namely, the time at which deafness has occurred. Perhaps half of our children are born deaf. Many others lose their hearing before they have learned to speak a large number of words, yet after their brains have received sound impressions by the thousands, which have certainly had an effect upon the part of the brain responding to the vibrations carried through the auditory nerves. Other children become deaf after they have made considerable progress in spoken language and even in music, the impressions of which can never be eradicated from their brains except by very serious illness or by an actual injury to the brain.

Our schools for the deaf, therefore, contain children who are partially deaf and children who are totally deaf; children whose mistakes in inflection and pronunciation may be corrected through the ear, and children whose mistakes of this kind may be corrected only through the senses of touch and sight. Our schools contain children who have learned to speak as you and I have, and whose voices before instruction are quite natural because they have been able to correct their mistakes and learn inflection from the speech of hearing people understood through the ear becoming deaf; other children whose brains have never received a message through the auditory nerve, to whom speech is and always will be merely a series of gestures made by these vocal organs, and whose thoughts will probably always consist of a series of pictures.

With these different groups of deaf children, is it possible to set up standards of speech and lip-reading which will be fair—fair to the teacher, fair to the child, fair to the parent, and fair to the public? I believe this may be done at least

roughly, because the real value to human beings of speech and of the understanding of speech lies in the ease with which thoughts may be transferred from the mind of one person to that of another. Therefore, the standard of speech must be intelligibility, and the standard of speech-reading must be serviceability. The principal value of speech to a hearing person is the fact that it is the shortest generally known manner of conveying his ideas to one or more other people. If the speech of a deaf child can convey his meaning to other people more rapidly than and as surely as writing, and, at the same time, cover as broad a range as written language, then it is worth while for the deaf child to have attained such a standard of speech. If he is able to understand the speech of conversation more rapidly than written language and as exactly, and if he can understand as wide a range of subjects, certainly the ability of the deaf child to read the lips to this extent is valuable and desirable.

It may be said that my standard of speech and lip-reading for the deaf is too high. It may be thought that we should consider more the value of speech and lip-reading which is successful with teachers and close friends though not with strangers. But it must be remembered that teachers seldom have close contact with their pupils in after life. Not only they but friends and relatives become expert in understanding poor and unpleasant speech, which is often unintelligible and unwelcome to the ear of the casual acquaintance, the employer, and the stranger. I believe it is right, therefore, to set a standard which the business world will accept; for that, after all, is the world in which more than half of the time of our deaf children must be spent when they become wage earners.

How many deaf pupils of our school can meet this standard of intelligibility in speech and serviceability in lip-reading to the extent that the business world will prefer to listen and to talk rather than to use the pad and pencil? We may start at once with perhaps from 40 to 45% of the whole number of our deaf children and say that they may attain such a standard. This group will be a large part of those

who have obtained their speech naturally and have lost their hearing after the age of 3 or 4 years. Their speech, acquired as you and I have acquired ours, may be largely preserved, though seldom improved, by suitable exercise and practice, (and in good schools is so preserved) that it may be fairly intelligible not only to friends but to strangers. Not all of this class of deaf children will become expert lip-readers. The successful reading of lips is partly a question of inborn talent. So many positions of the vocal organs are alike or nearly alike that successful reading of lips depends not only upon instruction and practice in the elements of speech, but also upon the reading of facial expression and upon mind-reading. It also depends largely upon the question of who takes the lead in the conversation. Light, distance, and the personal habits of speech also count. Many deaf people with quite intelligible speech and with plenty of brains have never been able to learn to read the lips well enough to make their efforts in this line actually save time and trouble over the pad and pencil method.

With the remainder of our deaf people (about one-half of the whole number), namely those born deaf or deaf at a very early age, the obtaining of a proper standard of success in speech and lip-reading is much more difficult. While the vocal organs are in almost all cases in fairly good condition, the speech produced even by expert teaching is more or less monotonous, mechanical, often unpleasant to the ear, and not particularly intelligible. Probably half of these children born deaf or deaf at a very early age may, by careful teaching, reach such a standard of intelligibility in speech and of ability to read speech as to make the time spent worth while; thus giving us a grand total of about two-thirds of all who are in our schools whom we may expect to come up to the standard which I believe we should set.

I do not wish to discourage the friends of *good* speech and lip-reading for the deaf, but I do believe the time has come when parents, school boards, physicians, in fact, everyone, should insist on better speech and speech-reading, on higher standards for both, and should see that the time and

money expended in the education of deaf children through speech and speech-reading is not wasted, and does not leave the deaf child without a real education, but with a practical education, and, at the same time, valuable results in speech. If speech is not intelligible, if lip-reading is not serviceable, both are useless, while a real education is always of inestimable value.

I confess that I fear that our standards in speech and speech-reading are too low. I fear that the enthusiasm of parents and friends, perhaps even of teachers, has laid too much emphasis on speech of *any* kind. We need now your honest criticism of the practical value of the speech we teach. Can you really understand it? Is it really agréeable or does it make you shudder? When you hear our children talk, do you really understand what they say, or are you tempted to say to us, "Splendid," and then to ask someone else, "What did the child say?" I sincerely hope that in line with Dr. Yale's suggestion, better speech and better lip-reading will be insisted upon throughout this country in schools for the deaf, and that the friends of oral teaching everywhere will bend their efforts at this time toward better general educational results, together with more speech and lip-reading which is not simply intelligible and serviceable to a few initiated, but which will stand the practical test of the business world.

There have been a number of plans pursued in recent years with a view to lead to an improvement in speech and speech-reading among our deaf children. One of these plans has been to start such work with the deaf child at the earliest possible age, even in its own home before going to school. While in the hands of very intelligent parents some good work may be done in this respect, especially in connection with the teaching of lip-reading, on the whole I do not believe it is a good general practice. The teaching of speech to the deaf should be done by experts. There are bad speech habits as well as good speech habits, and it is far better that the child should have no habits of speech at all than to

acquire bad ones from unskilled teachers which can hardly be eradicated later. I am strongly of the opinion that for the average deaf child whose parents never will be expert teachers of speech, the best thing to do with the child in the home, up to the age of 6 or 7, is to teach it good manners, good habits, and to develop it physically in every way, leaving the question of speech teaching, though possibly not of lip-reading, until the time for regular school work under the most skilful teachers has arrived.

Another movement toward the betterment of speech and lip-reading among deaf children has made much headway in this country. This has been the establishment of day schools for deaf children with the idea that the pupils shall be taught by the oral method during school hours and that they will associate with hearing children and adults at home during the remainder of the day, thus obtaining much extra practice in speech and lip-reading. My own observation makes me believe that this movement has not improved the standard, either of speech or of lip-reading, among the deaf children of this country. While the day schools may have brought more speech and more lip-reading and have reached many children who would not otherwise, perhaps, have gone to school, the standards already set in the better residential schools in the country in speech and lip-reading have not, I believe, been surpassed or even equalled in the day schools. The plea for a speech environment, which is used in connection with the day school plan or with the plan of unskilled oral teaching at home has really much less force than some would have us believe. A deaf child properly started and taught in a residential school by a skillful teacher for a number of years will form correct speech habits in a few years after entering school, and, with a reasonable amount of practice, will retain these habits.

The plea for a speech environment for the sake of better standards in lip-reading is a much stronger plea and justifies the generally accepted method in the schools of our country of dividing the deaf children where possible into two groups, and the school into two corresponding departments, in one of

which manual methods are largely used, while in the other speech and lip-reading with writing is used with the pupils.

There are several other general forces at work which must produce better standards in speech and lip-reading for the deaf. Among these is the movement, some years in progress, for the better training of our special speech teachers. In this respect the schools of the country are improving every year. The time has gone by when any normal or high school graduate is considered capable of teaching speech and lip-reading to deaf children after a six-weeks course in this special line of work. A year's preparation is now considered none too long, and even a longer period is demanded in some of our training classes.

The reduction of the size of classes taught is also a most important item in obtaining better standards of speech and lip-reading. This means, of course, more teachers and more expense, but it must be worked for in order to give the individual attention necessary to the production of the best results in our work. Better grading of the pupils is also of high importance. Better supervision of the work of the teacher is another element and shows us at once that the small isolated school for the deaf under the direction of a single teacher might possibly be a very decided failure, while the large school with a number of teachers carefully supervised by a competent head should always give fairly good results in this respect.

I believe another of the most important forces at work in recent years to advance our standards of intelligibility in speech has been a wider use of music and vibration. To go into this at any length would take all the time that has been allotted to me for my paper, but after visiting some of our large schools for the deaf in which special work has been carried out for a number of years in voice production with the aid of musical vibrations and musical rhythm, I am convinced that in time a considerable advance will be made by this means in producing more intelligible speech from our deaf children.

In concluding my paper, I wish to beg of you all to join in a demand for higher standards of speech and speech-reading in all of the schools for the deaf in our country.

There is no question but that extravagant claims have been made as to what can be done in both speech and lip-reading for deaf children by the uninitiated. Speech reading can never in this world replace hearing. Some deaf children will never learn to produce intelligible speech. There has been too much pressure in some of our schools for *any* kind of speech and *any* kind of lip-reading, and not enough pressure for intelligible speech and serviceable lip-reading. Deaf children must be educated, and education does not mean simply the acquiring of speech but the acquiring of the English language, the acquiring of a trade, the development of character, and the final ability to reach the goal of good citizenship. This goal, I am happy to say, has long been attained in our schools for the deaf, even when employing, exclusively, the manual method. Nothing of real education, nothing of character, nothing of independence, can be sacrificed for the sake of speech and lip-reading. Where high standards can be attained in these lines without sacrifice, such standards must be attained. In the numerous cases, however, where the speech acquired by the deaf child is not practical and not intelligible, and where its lip-reading is of little service, the child must be taught by other methods which will lead to mental advancement and give it a fitting education for citizenship.

PSYCHOLOGICAL STUDY OF THE DEAF CHILD.

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Psychology as applied to the study of the deaf child in its development from infancy to an independent status of maturity, is a complicated and many-sided problem which has taxed the capacity of parent, educator and scientist.

Child study has reached the unwholesome stage of "faddism." This fad has been actively stimulated by mothers of leisure, popular scientific writers in the magazines, ambitious and theoretical social service advocates and radical scientists. The fad is healthy as long as it remains active and within limitations; the enthusiastic advocates of such a fad contribute substantially to the good of the cause as long as their theories do not multiply in inverse ratio to their practices. Theory is the forerunner of practice, but in every science it must maintain a rational balance.

The psychological study of the normal child has made definite, effective progress, and the system of education now advocated is a remarkable evolution of the past few decades.

Were a trained pedagogue of a quarter of a century ago to walk into a modern schoolroom today, he would find a course of study, a plan of practical pedagogics, a disposition of the individual pupil, a scholastic atmosphere and a kind but positive influence,—working forces so radically different from that to which he had been trained that he might scarcely recognize the fact that these periods were in any way correlated.

To what should we ascribe this marked evolution? Has the child-brain become suddenly susceptible to a higher potentiality? Has the parent assumed a greater responsibility? Has the teacher developed a more forceful influence?

Or, is there a fundamental principle to which we may logically ascribe our present methods of training?

There has been no radical change in the quality or capacity of the child-brain other than that of increased perception. This increased perception has been made possible by a change in direction through which knowledge is imparted. There has been no greater responsibility assumed by the parent other than increased participation in the active work of the child. If a more forceful influence has been created in the teacher it may be credited to his improved method of demonstration, his maintenance of merit and honor systems, the abolition of corporal punishment, the increased sunshine in the schoolroom, the introduction of better hygiene and the contributions of medical science to the improved status of the individual pupil. This scientific contribution consists essentially of the examination of the eyes, ears, noses and throats of the pupils, and the proper direction and disposition of all defects here found. These defects we now recognize as the major cause of inattention, sluggishness, lack of application, and many other equally vital factors in the upbuilding of a child's character.

The foundation on which rests this modern educational reform may be summed up in one expression, "Applied Psychology."

What applies to the psychological study of the normal child must be concentrated in an intensified form in our responsibilities to the defective child. To those of us engaged in a careful study of the conditions and needs of the deaf child, the many handicaps daily met with often appear almost insurmountable.

The great English physicist, Tyndall, states that *all of the organs of special sense are but modifications of the sense of touch.* The sense of sight depends on the contact of a wave of light with the retina before a mental impression is formed; the sense of hearing becomes tangible only when a wave of sound has reached and stimulated the Organ of Corti; the sense of smell receives its impression from the contact of smellable substance with the end-filaments of the olfactory

nerve distributed in the nasal mucosa; the sense of taste is but a touch sense located in the sensitive areas of the tongue and palate.

If, then, Tyndall's theory is conclusive and accepted, we may readily comprehend why so much stress is placed on the development of the tactile sense in the education of the defective child. The higher development of tactile impression is not a recent innovation in the training of the deaf. Even Montessori, in emphasizing the importance of tactile sense-training in her system of special education, has adopted this important educational adjunct from the system employed in teaching the deaf and the blind.

The organs of special sense are the means through which every perception of the human mind is made possible. If a child has unfortunately been deprived of the sense of hearing, it creates a defective force to be reckoned with in every phase of the upbuilding of the child's character. Every physical stimulus, every mental impression, every moral influence must be given consideration from an unusual angle in its transmission to and interpretation by this child. The very nature of a deaf child is cast in a different mould from that of the normal child; the absence of the sense of hearing confronts us with a serious problem in every phase of development in the intellectual life and spiritual education of this child.

Classification.

In attempting to classify psychological principles in their application to the education of the deaf child, I offer the following somewhat arbitrary but comprehensive subdivisions:

1. Observation.
2. Concentration.
3. Imitation.
4. Memory.
5. Correlation.
6. Imagination.
7. Rhythm and mechanics.

The subdivisions of this classification all admit of practical illustration and application, and I have purposely avoided the theoretical and abstract phases of psychology. Of course, it will be difficult to confine our discussion within the prescribed limits of such subdivision, as it will be found that one phase of our applied science merges into the other, or is closely bound up with several other phases.

1. *Observation.* Whether the faculty of observation in the deaf child is developed largely through the sense of touch or through the sense of sight the fact remains that tactile impressions are our most reliable and tangible forces in stimulating the child's mind.

Let us assume that the child before us is totally deaf, is five years of age, and has had no special or technical training. At this stage of his development he has acquired many of the habits, manners and acts of normal children, but his power of observation has been seriously handicapped by the limited avenues through which his mental functions are stimulated.

For the training of sight we use gestures, gymnastics and, later, special movements of the tongue, lips and palate. Recognition of form is accomplished by a combination of the sense of sight and touch.

The use of blocks and geometrical solids to stimulate the touch and sight faculties is an effective method of sense training and may be considered in various stages:

(a) The child is shown a geometrical solid and is then asked to select same by sight from a number of different-shaped solids.

(b) The child is directed to feel a solid object while closing the eyes and is then asked to recognize the same object by sight. This correlates his sense of sight and sense of touch.

(c) The child is shown a solid object and then selects same by sense of touch with eyes closed. This is the reverse of the second step.

(d) From a series of blocks of different shapes, the child is asked to select one block by sense of touch. This block is then

returned to the rest of the collection and the child directed to select same by sense of touch alone. This sharpens the tactile sense for comparative sizes of lines and surfaces.

(e) Two blocks of slight variation in size and shape are presented to the child; he selects one by sense of touch and is then required to find that particular block from a larger group of objects.

In similar manner, the pupil learns to differentiate textures and irregularities of surfaces and the touch-sense is so acutely sensitized by constant practice that he is eventually enabled to distinguish the difference in vibrations of musical tones, the differential vibrations of the voice in the throat and chest, which is a vitally important factor in his technical training. Not only does this practice develop his power of observation, but it also stimulates his faculties of concentration, memory and correlation.

2. *Concentration.* One of the real difficulties encountered in the early training of the deaf child is his lack of concentration. In reading, independent study, and other mental activities, the advanced deaf pupil has the advantage of being able to concentrate his mind on his work without the added extraneous diversions of noise and all forms of sound to which the normal hearing child is subjected. On the other hand, the deaf child not only sees but also *hears* through the sense of sight and is constantly on the alert for all visible changes in the schoolroom and in his surroundings even when attempting to concentrate his attention on the individual work prescribed for him.

When a photographer desires to pose a prattling, restless, lively baby before a camera, he arrests his attention by holding some bright or unusual object before the child at a fixed point. This momentarily arrests the child's attention and gives the photographer his opportunity for a picture. A crying baby is cajoled by a rattle or other sound, a moving, bright object, clapping of the hands, sudden change of position, patting on the body, or any of the other numerous resources employed to arrest the child's attention. *Attention* is the basis of concentration- concentration is an indispensable aid to teacher and child.

Our deaf child, therefore, must have his attention engaged in some familiar way by which faculties already alert, may be stimulated.

In the class-room a favorite method of developing the power of attention in the young deaf child is the use of *matching exercises.* Matching colors and objects not only trains the eye, but develops memory and concentration. Even though the child may not know the names of the colors he is asked to compare, he instinctively cultivates a comparative color-sense by such practice. By the use of matching charts the teacher studies the dawning of the child's attention faculty and the child becomes more interested in the work of the teacher and in the acquisition, day by day, of new ideas. He cultivates concentration and the pleasure of learning. The more attractive we can make the form and character of the child's daily instruction, the more readily will we get his co-operation.

3. *Imitation.* One of the fundamental principles in the education of the child is imitation. Imitation is the foundation on which we build gesture, expression, speech and all voluntary movement. It, therefore, is utilized as one of the most valuable aids in child-training.

Imitation develops almost simultaneously with observation. The first use of the organs of speech, as the tongue and lips, and the use of the breath, are taught through observation and imitation. The child that has never spoken a word is shown a feather or a slip of paper. The teacher holds the feather or paper close to the mouth and blows lightly and sharply upon it. The child sees the act and feels the impulse of breath and is directed to imitate it. The result is the letter "p," "t," "f" or some breath consonant, depending on the position of the lips and tongue. The differentiation of these breath consonants soon becomes apparent and the way is prepared for more complicated sounds.

The positions and movements of the tongue are both observed and imitated. Quick hand-movements and gestures give the child additional opportunities for imitation. From the combination of movements of the tongue and lips, speech is gradually evolved. Correct breathing is acquired with

somewhat more difficulty. Incidentally it might be added that insufficient attention has been given to breathing and breath control in the training of the deaf child and in the correction of defects in speech.

Imitation is further accentuated by directing the child to reproduce objects that it sees and movements that are made. Three marbles are held up from a box of marbles; the child is directed to produce the same number of marbles, and this, his faculty of imitation soon enables him to do. Two kindergarten sticks are placed at right-angles to each other; the child is asked to reproduce this position and when this has been effected, he is asked to draw lines on the board in the same position. If he does so correctly from the objects before him, observation and imitation have been called into question. If he draws the object on the blackboard without seeing it, another faculty is being stimulated.

4. *Memory.* Memory combines the three previous faculties, observation, concentration and imitation. Memory is required to produce speech, to perform an act, to spell a word, to call a name, and to reproduce any process of mental activity.

The normal child first acquires speech by meaningless repetition of some elementary sounds. Before the babe can say "mama" it prattles "mamamama" or "papapapa" without significance. This principle has been recognized as the basis for teaching speech to the deaf. Miss Josephine Avondino, of the Central Institute for the Deaf, whose work along this line has been especially intensive, in describing her "system of babbling," says, "The movements of the muscles of the body of a very young infant are but evidences of the instinctive impulse to act, and, specifically, the movements of the lips and tongue and the cooing of a baby are the instinctive preparation for speech. This elementary stage of vocalization soon passes and he reaches the babbling stage. This stage extends over a long period until definite sounds and syllables are gradually acquired."

The cultivation of memory for the acquisition of speech in the deaf child is of even greater importance than memory training for the normal child.

5. *Correlation.* The essential principles of observation, concentration and imitation are the a, b, c to the acquisition of speech. To this we add memory for the reproduction of speech, but there is still a vital factor necessary to the unfolding and higher development of the child's mentality—the comprehension of speech. A child may be taught the word *mother*. It may then be told that the word *mother* applies to a definite person. These two mental impressions may exist independently in the child's mind. The climax of these impressions, however, does not become apparent to the child until he realizes the relationship between the word *mother* and the person to whom this word applies. This association of ideas, or as we have classified it, correlation, constitutes one of the most subtle refinements in the psychological study of the deaf child.

When correlation becomes active in the scholastic work of the deaf child, his mind receives a tremendous stimulus, and from that time we note a decided advancement, not only in his scholarship, but also in his speech work, facility of expression, and working ambition. A practical example of this unfolding of the child-mind is presented in the following case:

E. M., a girl of seven, was admitted to the Central Institute for the Deaf, September, 1914; she was born deaf; functional tests corroborated this statement. There were not even tone-islands of hearing; at a distance of six inches the child was able to repeat the vowels *Ah! Oh!* when called into the ear in a loud voice; the differentiation was uncertain.

This little girl is now in her second scholastic year of oral training; she reads, writes and speaks with fair fluency as compared to a normal child in the same period of training. Her speech is fluent, her voice flexible and well-modulated. As soon as this child was able to comprehend, read, and speak phrases and sentences, it occurred to me to apply the principles of re-education as advanced by Urbantschitsch, Bezold, Gradenigo and others. I was astonished to find after a few trials that this child could perceive spoken words and phrases when called into the ear with a moderate volume of voice.

Today she is getting her training not only by speech-reading and articulation, but by actual auricular exercises. She can even repeat sentences containing words of which she does not know the meaning and her oral training progresses much more rapidly with the assistance of her increasing hearing capacity.

We have been taught that in the congenitally deaf child the organ of Corti shows but an atrophied remnant of filaments of the cochlear nerve. What, then, has been the reconstructive or regenerative status that has taken place in this child's auditory perceptive mechanism? Re-education of the deaf implies, as its name would indicate, the re-stimulation of a sensory apparatus that at some time was active. In this case, however, there had never been an active auditory sense and the actual hearing capacity of today must be regarded as a new and constructive feature and not as a re-education or re-construction. What the psychological element stimulated in this case might be, I am as yet not prepared to say.

I would say that the marked stimulation in this child's mentality and speech began at the time when the association of ideas or correlation of words and thoughts was first developed.

6. *Imagination.* Independence and facility of expression are best developed by cultivating the power of imagination. Last week the editor of one of our influential daily newspapers visited the Central Institute and related an interesting story to a number of our pupils of eleven or twelve years of age. The story contained, perhaps, a thousand words. The *raconteur* is a man with a full beard and his speech is rather nervous and rapid. Six of our children listened to the story and acquired the subject matter entirely by lip-reading. They were given a pad and pencil and asked to write the story as they had received it. The written story in each of the six children was expressed with individuality, conciseness and accuracy. The essentials were maintained but in each instance the form and character of the story was reconstructed in accordance with the mentality and imaginative ability of the pupil. It was interesting to note how much variation

could be given by these child-minds in this instance. Imagination, as a psychological element in child-training, offers splendid opportunities for independence of expression and it is in this form of practice that such facility of expression is developed. M. W., an eight-year-old girl, lost her hearing completely at three years of age following an attack of cerebro-spinal meningitis. She has been a pupil of the Central Institute for two years. Last week she was given a picture chart and asked to write the story which the picture suggested to her mind. Here is her story:

THE LITTLE LOST CHILD.

One day last spring, a little girl was lost. Her name was Annie. She wore socks and slippers. She had a little dog. His name was Fido. She stood on the street under a big umbrella. She was looking for her mother. She cried because she could not find her home. In the night she was very tired and sleepy so she sat on the grass and went to sleep. In the morning she got up and said, "Oh, I am so hungry. Where shall I go?" After a while a woman saw her crying. She asked her what was the matter. Annie said, "I am lost and don't know how to go home." Then the woman took her to a store and bought her some ice cream and candy. After a while she was taking a walk down the street when her mother saw Annie. She took her home. Annie was glad to see her mother and father and she resolved not to take a walk by herself again.

The imaginative sense expressed by this child is the more remarkable when we consider that her home surroundings are somber and her nature serious. With the stimulation of her imaginative faculty, additional sunshine is injected into her scholastic work and a new impetus given to the child's ambition. Cultivating the imaginative sense materially assists the child in language construction, and develops actual, rather than abstract, expression. Imagination stimulates originality and actively assists in enriching the child's vocabulary.

7. *Rhythm.* An unconscious accessory in child-training is the mechanical or automatic correlation of movement in the perception or vocal expression of thought or action. A number of our pupils have been taught to vocalize the musical scale comprising a whole octave. These pupils hear no sound. The notes that they produce with a fair degree of accuracy are evoked by purely mechanical means. They are taught tone placing, the position of the larynx, direction and pro-

jection of the voice, the control of breath and the intensity of voice vibration. Their tones are even sustained and mechanically correct. Their control is measured entirely by the tactile sense, especially the sensation of vibration and the differentiation of resonance. Tyndall has made the pertinent observation that light, sound, heat and electricity are all phenomena produced by waves of motion, varying only in degree, quality and intensity.

An ingenious adjunct in the training of the deaf has been introduced by a progressive Eastern teacher. By the use of the piano the deaf child is trained to interpret differences in pitch of a vibrating note or chord. We have used this training constantly with our pupils. The pupil stands with his eyes closed and his fingers resting lightly on some part of the wooden piano case, or in some instances the pupils stand with their back to the key-board some distance from the instrument, depending on the transmission of vibrations through the floor. They can differentiate the bass chord from the middle register; a middle register from the upper *clef,* and these notes or chords can be struck in every variation and interpreted by the pupils with accuracy.

The physical principle involved in this experiment is obvious, the lower the pitch of the note the fewer the number of vibrations per second; the higher the pitch of the note, the more frequent the vibrations per second. It is not the hearing faculty of the pupil, however, which makes this tone differentiation possible, but the actual sharpened tactile sense by which the difference in rapidity of vibration of a sustained tone is perceived.

The value of this mechanical production of the musical scale or the interpretation of the musical vibration to differentiate the pitch or a note has an important and significant application in our work with the deaf. There is a characteristic and almost invariably present monotone in the speech produced by the deaf and it is to overcome this noticeable defect in speech production that we lay unusual stress on the mechanics of voice production. By increased flexibility of voice, greater accuracy in pitch, better volume

and more and more natural placement, we hope to reach such a high degree of efficiency that this characteristic monotone may be eliminated.

Discussion.

Dr. Emil Amberg, Detroit, Mich., asked Dr. Hall whether the advantages of the institutional life of the deaf child were sufficient to overcome the disadvantages of leaving home. A day school had been established in Detroit for the purpose of obviating the necessity of the child leaving home. He asked whether it is not advisable, from a humane point of view, to sacrifice a little of the standard in favor of home surroundings. The whole question might perhaps be solved by raising the standard of the individual teacher.

Dr. E. B. Dench, New York City, thought parents could accomplish more by training the child to be good and well-behaved, leaving the special training in speech to teachers. As soon as it was discovered that a child was deaf, the parents, as a rule, began to spoil it; teachers, therefore, before they could do anything with it, had to undo the petting and spoiling it had had at home. He had been particularly interested in Dr. Hall's suggestions along this line.

Dr. Walter B. Swift, Boston, Mass., asked Dr. Goldstein why he suggested using the sounds *an-na, an-no, an-nē,* etc., instead of starting with such words as *any, Anna,* etc. Why could not the teaching of lip reading be accomplished by means of moving pictures, then reducing these movements by reducing the size of the pictures?

Dr. Hall, in closing the discussion, wished to emphasize the point, in connection with the question of day schools, that such schools should be large. The day school in Detroit, to which Dr. Amberg referred, was a large one and hence a successful one, doing very good work. All such schools had certain disadvantages, however, as at present constituted. One of the most important things in the teaching of the deaf was

to teach them to become good citizens by making them wage earners, and for this purpose the state residential schools were better equipped than the day schools or the private schools. In the matter of teaching these pupils to earn a living, the state schools had been ahead of all other schools. The very small day schools, such as existed in many places, had the disadvantage of having only one teacher, the children were not graded, there was no chance of doing very much individual work, and the progress of the child could not be very great. In the best residential schools an effort was being made to combine the home with the school by the adoption of the cottage plan, thus making the school approximate the home as nearly as possible. The regular habits acquired in residential institutions were very beneficial. Some parents were wise and knew how to handle the deaf children, but many did not, and petted and spoiled them.

The teaching of correct breathing to deaf children, which the teachers had learned from rhinologists and laryingologists, was a very important part of the oral work.

Dr. Goldstein, in closing the discussion of Dr. Hall's paper, said: "In the consideration of oral training, there is but slight difference between the congenitally deaf child and the one who has lost hearing at an age before speech has been acquired (two years of age or younger). Otologically, all functional tests of hearing would demonstrate the absence of audition; pedagogically, the same methods of teaching speech must be practically applied.

The personal equation of the teacher is a very important factor in oral training. A poor teacher rarely obtains good speech and a good teacher may sometimes obtain indifferent speech, but serviceable and intelligible speech, if carefully cultivated in the totally deaf child in a very substantial majority of cases where the child begins training at an early age.

There is much significance in Dr. Dench's observation concerning the home surroundings of the deaf child. Intelligent co-operation on the part of the parent is a big asset.

There is much to be done in the proper instruction for parents of deaf children and there is even more work necessary in developing the co-operation of the general medical profession.

The suggestion of Dr. Swift to use the moving picture and the greatly magnified picture of the Visible Speech organs in lip-reading instruction was theoretically good, but practically of little service. The deaf child would have much difficulty in relating the familiar picture of the mouth, lips, teeth and tongue to the very large image thrown on the screen, and it would simply offer another obstacle in training, both to teacher and pupil.

Dr. Swift asked why a polysyllabled word could not be taught the deaf child as easily by repetition of the individual syllables as by means of the system of "babbling" which had recently been successfully presented by a progressive oral teacher. The "babbling" system is built on a foundation of the early and natural attempts at speech and, as such, offers a simple, comprehensive and effective system by which speech may be acquired. It is the a-b-c of speech, and, systematically applied, may be used successfully in every case, while the desultory attempts to acquire strange and unusual syllable combinations have met with many difficulties at the hands of experienced teachers.

THE RELATION OF THE EAR TO THE CENTRAL NERVOUS SYSTEM.

By J. GORDON WILSON, M. B., Chicago, Ill.

The purpose of this paper is twofold: (1) to urge the attention of this meeting of otologists to a more close attention to the connections of the acoustic and vestibular mechanism in the central nervous system; (2) to present briefly two cases illustrating the desirability of a closer co-operation of otologist and neurologist.

It must be evident to all of us that the amount of attention that has been paid by otologists and by neurologists to the central connections of the eighth nerve is out of all proportion to the attention paid by ophthalmologists and neurologists to the second nerve.

The time has gone when the competent otologist can limit his attention to the peripheral organ of the eighth nerve. In his diagnosis he can no longer confine his attention to the temporal bone, no matter how strictly his practice be limited to its diseases. It is well that this is so, for such a narrowing of the field of specialization tends to an exaggeration of the importance of local symptoms, to a lack of appreciation of the significance of general phenomena, and at times to error in diagnosis.

The time has come when the otologist may well aim to extend his accurate and particular knowledge of the peripheral mechanism in which he specializes to the complex associations of the central connections of the cochlear and vestibular divisions of the eighth nerve. The time has come when a closer working together of neurologist and otologist is to be desired. A pleasing progress has already been made along these lines. In one of the cases here recorded the question of the significance of the diminution of hearing could only be determined by such co-operation.

The ophthalmologist has so extended his knowledge of the peripheral organ of vision as to be of great use to the neurologist in the diagnosis of lesions of the central nervous system. When one considers the anatomical side and judges only by the comparative length and diversity of connections of the second and of the eighth nerves, the prospect of at least equal usefulness awaits the otologist. Again when one studies the mental deterioration of the deaf and dumb as compared with the deterioration of the blind one recognizes the great importance in mental processes of the hearing organ. "Deafness in early life is a much more serious disability than blindness; and the mental strain, involved in such an extremely abnormal mode of performance of the cerebral functions as is common in the subjects of the former, often results in the development of insanity followed by dementia." (Bolton, The Brain in Health and Disease, London, 1914, p. 128.)

The first essential for such work is (1) a competent knowledge of the anatomical connections of the cochlear and vestibular pathways and (2) an intelligent understanding of the function of the peripheral organ. Concerning both of these our knowledge is inadequate, especially of the central connections and functions, yet it is such as to enable us to make a beginning. The aim should be by careful application of methods which are now at our disposal and others which undoubtedly will later be added, to reveal the significance of the function of the organ we are specializing in. With this will come the recognition of the possibilities for usefulness which legitimately lie within this field.

It is not the purpose of this paper to discuss the anatomical path of the cochlear nerve. For the present I only wish to recall to you certain points which have a bearing on the case I wish to record.

The acoustic path begins in the primary acoustic nuclei (spiral ganglion of the cochlea) from there passes to the secondary acoustic nuclei (dorsal and ventral acoustic nuclei). Then the fibres decussate in the trapezium and are continued up in the lateral fillet (of Reil) to the posterior

corpora quadrigemina and then to the mesial geniculate of the thalamus. From there they pass in the retrolenticular part of the internal capsule and end in the first temporal lobe. From the hemi-decussation (Monakow) that probably takes place in the trapezium complete contralateral deafness is not likely to take place from temporal lobe lesions unless there is some pressure on the upper lateral fillet or an already damaged ear.

When one considers the temporal lobe and its so-called acoustic centre, one is justified at present in saying that the chief portal of entry to the cerebral cortex for sound impressions is a relatively narrow one in the region of the first temporal convolution, and as Monakow suggests it is probable that from there fibres pass to the tegmentum and then to the eye nuclei. It is known that locally limited lesions in the temporal region, especially the left, cause word deafness (sensory aphasia), and when the lesions are bilateral central deafness. Central deafness shows that the perception of sound can be impaired or even destroyed by injury to a relatively sharply defined area and in conjunction with the psychic (inner) awakening of sound. We know very little about unilateral central deafness. The deafness which follows disease of the temporal lobe of the opposite side is of short duration. (Oppenheim, H. Text Book of Nervous Diseases, Edinburgh, p. 631).

In many cases of diminution of hearing, with a peripheral organ already impaired, we are apt to forget the effect of fatigue. Such cases present themselves, for instance, in sclerosis of the ear with neurasthenia. From what we know of nerve fatigue with the relatively greater susceptibility of the cerebral cortex to fatigue I believe we are justified in paying considerable attention to the central mechanism in these cases. I am becoming more convinced that we do not pay sufficient attention to the results of fatigue in those who have from any cause a hypoacousis.

The case I wish to record is that of a boy whose impaired hearing appeared to me to be due to some weakness of the central nervous system and well illustrates from its diffi-

culties in diagnosis a type of case which presents itself in a clinic.*

Alfred K., 16 years of age, was referred to the clinic on account of deafness. His mother, a healthy intelligent woman, could give no hereditary history of deafness. She knew that the boy had been deaf for five or six years anyway and could not be sure that he had ever heard well. He had had whooping cough when five years old and scarlet fever three years ago but was known to be deaf before the latter illness.

"K" is in the eighth grade in school and the studies in which he does best are arithmetic, reading and physiology, while those in which he is poor are geography and spelling. He says he does not hear all the teacher says in geography and one can easily see how defective hearing might affect spelling. He whistles a little according to his own account but does not sing, does not like to. In the summer he is employed as a caddy on the golf links. He is in good physical health.

Examination showed nothing organically wrong in the ear. The tympanic membranes were normal, the eustachian tubes normal, throat and tonsils normal, and the ossicles freely movable. Rinné positive, bone conduction diminished. Weber not referred. Rotation tests give normal results although the reaction was sluggish. His range of hearing was good, from 24 to 16000 dv. in the right ear and from 24 to 12000 dv. in the left, tested with Edelmann forks and the Galton Edelmann whistle. The hearing distance was shortened for watch, whisper and normal voice—

L. ear—voice 10 ft.; whisper 1 ft.; watch 3 ft.

R. ear—voice 8 ft.; whisper 1 ft.; watch 2 ft.

(This relation of the whisper to the watch was very much the reverse of the normal.)

As the clinical tests did not adequately account for the degree of deafness it was thought that the deafness might be a

*I am indebted for most of the notes to Miss Vincent, lecturer on Psychology, Chicago Normal College, who reported the case fully at the Western Psychological Association, 1913.

part of a general mental dullness and that probably the boy's vision if tested would show an equal deficiency. Deafness is always noticed readily by the family, since it so seriously affects social intercourse while one may be very deficient in visual acuity and the fact quite escape attention.

He was given some of the standard tests for auditory and visual memory. His reaction times, visual and auditory were taken by means of a Vernier chronoscope, and he was given the Binet tests for general intelligence.

I. The Digit Test: Two series of from four to nine digits inclusive were given using both auditory and visual presentation (The method used was that described in Whipple's "Manual of Mental and Physical Tests," p. 362).

Errors were counted according to the Ebbinghaus' method —omission one error; every displacement in the series by two or three places one-half error; every displacement by four or more places, one error. He made 8½ errors in reproducing the visual series, and 26½ errors in reproducing the auditory series. He said he could hear the digits perfectly well.

"K's" auditory span is 6 digits, and his visual 7 digits. Jacobs found for the same age an average auditory span of 8 digits. Ebbinghaus says that the average number of errors a boy of 15.5 years makes in the 8 digit series in the auditory tests is 1. This boy made an average of 4.75 errors in the same series.

Thus on the whole, while "K's" auditory span is not greatly shortened, but beyond a certain limit it is far more inaccurate than that of the normal boy of 16, it is also far less perfect than the visual span.

II. Association Tests. The following list of words were given him. Opposite the second series, he was asked to write the color of the object; opposite the first, he was asked to write the names of any sounds connected with the object or which could be made with or by it. It was recognized that the latter test is the more difficult, but the time was not limited. He wrote the color names as fast as possible but

hesitated a long time over the sounds, finally producing the following:

engine .....tooth, tooth	snow .....white
watch	sky .....blue
cat	grass .....green
dog .....bo ra	rose .....red
baby ..... cry	lily .....white
pigeon	leaves .....green
bell .....dint	sunset .....yellow
pig	flag .....red, white, blue
cow	brick .....light brown
chicken ....cluck	orange .....yellow
duck	grapes .....blue
rain	your own house.white
hammer	
fire	
wind .....blow	
organ	

These things were all familiar to him. He said he knew all of the animals, and had had most of them. The results were confirmed by similar tests on other days. One day the following list was given him, and he was asked to write the name of anything which made the sound:

List:— Puff, squeal, rattle, bang, clatter, crack, patter, slam, hiss, crackle.

He looked at the list blankly for some time and finally said, "I don't know anything that makes those sounds." "Do you understand the words?" he was asked. "Oh, yes," he replied. They were then read to him, but he said he could not think of anything that made the sounds. His auditory memory was apparently defective.

III. Reactions Tests. These tests 25 trials each on three different days gave .241 for the visual tests and .276 for the auditory. Titchener gives .27 for the sensory visual reaction time and .22 for the auditory. It is suggested that his superior visual reaction may have been due to his training as a caddy.

IV. The Binet Tests. The Binet tests showed him four years retarded. He could not do all the tasks set for the 11th year but did accomplish some of those in the years beyond. The rhymes proved too hard for him. He was given all five words, and asked to write three rhymes for each. These are what he wrote:

Ball—boys, boy,
Din—dins, sin,
Coy—toy, toys, coy,
Feet—foot, feets, foot
Spring—
Money—gold, silver, copper.

He wrote the lists of opposites fairly well, failing in some but omitting only two words. One of these words was loud, the only auditory word in the series.

Pitch Discrimination. The boy has a monotonous voice which would lead one to suspect that he is lacking in pitch discrimination. When asked to imitate different pitches, to hum or sing them, either after the voice or the fork he failed absolutely but this may have been entirely due to difficulty in tone production and not to any defect of hearing. When forks were applied successively to the ear he found it very hard to tell which was higher and which was lower. This may have been a result of intensity differences which are always confusing to the untrained subject and which could not be entirely controlled by this method. It was then determined to have him try to match forks of similar vibration rates. There were a set of five small forks of octave intervals from 128 dvs. up, and 16 large Edelmann weighted clinic forks.

These two series were very dissimilar in appearance and the pitch marks were also different. The forks were spread before the boy, one was held to his ear and he was asked to find another like it. He succeeded with difficulty in matching all five octaves. The smaller forks were older and were somewhat flattened. He never found a match which satisfied him. When he finally settled on a fork which he said was the nearest to the one he was matching then the large fork

was taken and the weights moved up and down until he said they were the same and usually the final differences were very slight.

Dictation and Repetition: "K" was no trouble in writing from dictation or repeating anything given him orally.

From these tests we learn (1) that the boy has diminution of hearing; (2) that this diminution is accompanied by:

(a) a shortened distance for sound.

(b) a shortened memory span.

(c) a more inaccurate auditory memory as compared with his visual.

(d) a failure to associate sounds with objects or objects with sounds as revealed by the association tests.

(e) poor discrimination of sounds as sounds, shown by lack of descriptive terms for sounds.

(f) lengthened auditory reaction time.

(g) a retardation of four years according to the general intelligence tests.

On the other hand the tests show that there is no discoverable defect of the middle ear or the labyrinth, that the range is almost normal, the pitch discrimination fair and that the auditory-visual connection as well as the auditory motor hand and speech connections are intact.

This case is presented with no diagnosis. The writer believes that we have here a deficiency in the central mechanism, it may be associated now or in the past with some obscure peripheral lesion. To the writer it has been helpful in leading him in obscure cases to consider deafness from the central as well as the peripheral standpoint and has raised in his mind the question of improvement of such cases by education.

The second case which I wish to record is one in which on caloric stimulation of one labyrinth the slow deviation of the eyes or labyrinthine phase of nystagmus appeared, but the quick or cerebral phase failed to appear, whilst the normal reaction appeared on stimulating the other labyrinth. With this anomalous reaction there occurred during the duration of the labyrinthine

reaction, the inability to move the eyes beyond the mid line in the direction opposite to the slow deviation. This is so far as I know a unique observation. It is especially of interest to me since four years ago Dr. Pike and I predicted that such a possible reaction would be found in man as we had found it frequently in animals after certain definite cerebral lesions. Before reading the history of this case I would like with your permission to recall what we found experimentally.

In 1912 as the results of our experimental observations we said:—

"Nystagmus occurring in the dog and cat, as a result of labyrinthine stimulation or destruction, consists of two phases—a slow deviation followed by a quick return—varying definitely in direction with the labyrinth which is stimulated or destroyed. As we have shown in this paper, these two phases are distinct. Thus the slow deviation is not affected by removal of the cerebellum, nor is it affected by complete removal of the cerebrum, optic thalamus, partial removal of the corpora quadrigemina, and longitudinal splitting of the cerebellum. In short, if the anatomical path from the labyrinth through the vestibular nuclei to the eye nuclei (posterior longitudinal bundle) be intact, the deviation can be produced by stimulation, and appears after destruction, so soon as the animal begins to pass out from under the influence of the narcotic. Deviation appears at a time when the reflex responses of the leg muscles are completely in abeyance, and pari passu with the corneal reflex."

"On the other hand, the quick phase of nystagmus, though not affected by removal of the cerebellum or of the occipital cortex, is affected by removal of the whole cerebral cortex. It does not occur in animals completely decerebrated, including the optic thalamus, even though the oculo-vestibular tract be unimpaired. Further, it appears later than the deviation, and can only be produced, or will only occur, when the animal emerges from the effect of the anesthetic." (Philosophical Transactions of the Royal Society of London. Series B. vol 203, 1912, pp. 127-160).

Later as a result of further observations we said (The Transactions of the International Congress of Medicine, Section of Otology, London, 1913, p. 565):

"Since our former results were published, we have repeated in detail these experiments and with the same result. Accordingly, we feel justified in saying that neither the slow deviation nor the quick return has any necessary pathway nor any indispensable centre in the cerebellum.

"The quick movement in nystagmus arises from some mechanism above the corpora quadrigemina, a point in which we confirm Bartels' view.

"There are two possibilities: 1. Both cerebral hemispheres may be involved in the production of the quick phase of nystagmus when the slow component is in a given direction. 2. Only one cerebral hemisphere may be involved. If only one is involved, what relation does it bear to the direction of the slow or labyrinthine phase? Experiment shows that the second possibility is more nearly the true one so far as the lateral movement is concerned. Space does not permit the recital of the details of the experiments at this time, and a brief presentation must suffice. This conclusion is based on the following:

"1. The results of removal of one labyrinth and one cerebral hemisphere, noting the presence or absence of nystagmus.

"2. The results of electrical, caloric and rotation tests in such animals.

"3. The results of electrical, caloric and rotation tests in animals in which both labyrinths are intact, but in which one cerebral hemisphere had been removed.

"As a general result, we may state that complete removal of the cerebral hemisphere on the side of the slow deviation abolishes all except a small rotatory component of the quick phase of nystagmus. Complete removal of the cerebral hemisphere of the side toward which the quick component is directed has but little effect on the quick movement.

"We may here note in passing that injury to the anterior corpus quadrigeminum of the side to which the slow devia-

tion of the eyes is directed does not abolish the nystagmus, either in its slow or quick phase, but it does bring about a dissociation of the eye movements.

"We have attempted in cats, dogs and monkeys to find some region in a hemisphere where a lesion will modify or abolish the quick phase which follows stimulation or destruction of the labyrinth. In the course of the experiments we have removed the various areas of the cortex, frontal, parietal, occipital and temporal, and have also at times destroyed the subcortical ganglionic masses. Having destroyed these areas, we have then stimulated one or both labyrinths with the electrical current, with hot and with cold water, and by rotation. We have also in many of these cases destroyed one labyrinth either concomitantly with or subsequent to the cerebral lesion—a labyrinth either on the side of or opposite to the cerebral lesion. We cannot at this time enter into the details of the results, which will be published in full later, but we desire to state here that the only region where we obtain consistent alteration of the labyrinthine stimulation, and that only so far as the quick component is concerned, is the region of, or adjacent to, the temporal lobe. In these cases we found that stimulation of the labyrinth on the side opposite the cerebral lesion with cold water or with the anode gave typical labyrinthine nystagmus, lateral in character, while stimulation with hot water or the cathode gave deviation, but no lateral nystagmus. We also found that destruction of the labyrinth on the side of the cerebral lesion gave no nystagmus. There was further noted in some of our cases that the eye on the side of the lesion showed a rotatory movement around an anteroposterior axis, while this movement was wanting in the eye of the opposite side.

"To sum up, our idea of the mechanism of nystagmus is first, an agency somewhere which produces a deviation of the eyes from the primary position of equilibrium or the primary position of the line of fixation of Listing. In labyrinthine nystagmus, this agency lies in the labyrinth.

"Lesions of the cerebral hemisphere on the side of the slow deviation of the eyes abolish or reduce the quick component, since it is from the hemisphere of this side that efferent impulses concerned in the pulling of the eyes back to the median line arise."

I have been able this spring to extend this observation to man and wish here to record the case:—

Mr. K., *admitted to Wesley Memorial Hospital March 8, 1916, aged 42. Complains of dizziness, forgetfulness, hemiparesis, failing vision, diplopia, headache.

History:— Patient first noticed last October a beginning weakness of vision; no other complaint until January, when weakness in the right arm made it necessary for him to stop writing. Soon after he noticed weakness in the right leg which in February became so marked that he fell frequently to the right. Had tendency to walk to the left and began dragging the right foot.

Three weeks ago occasional dizziness caused him to fall; these attacks were worse when patient got up from sitting posture. Diplopia noticed a month ago. Forgetfulness and some evidence of mental derangement have been gradually increasing for the last month.

Headache continuous but not severe, not localized to one part of head.

Past history: Typhoid at twenty; no other illness, no venereal disease.

Family: Wife well, three children, no miscarriages.

Present condition, March 9: Upper facial showed equal movements on two sides; paralysis of the right lower facial. Tongue deviates slightly to right. Right arm and leg paretic. Open jaw deviates to the left. Jaw jerk inconstant. Supraorbital reflex present on both sides and equal.

Marked weakness of the right upper and lower extremities. Left upper and left lower limbs normal. Movements of the right arm slow, spastic, incoordinate. Unable to perform

*I am indebted to Drs. R. C. Hamill and L. J. Pollock for the neurological notes.

such movements as scratching the head or touching points of the face, no apparent atāxia of the leg.

Wrist, triceps and biceps reflexes on the right + +. On the left + + but not so brisk as right. Abdominal reflexes—both present, right much diminished, left normal.

Fine movements abolished in right hand and fingers. Good strength in grip in right hand though not so good as left. Reduction of strength in large movements in right arm and leg. Some resistance of passive movements in right arm and leg. Achilles left brisk. Ankle and knee clonus in right leg; none in the left. Plantar frank on the left, at times absent on right. No Babinsky, but occasionally a suspicion of Oppenheim on the right. No Chaddock.

Cremasteric diminished on both sides, more frequently on left then on right. Abdominal reflexes present and equal.

No analgesia. No anesthesia to gross touch or cotton. Temperature sense normal, taste and hearing normal.

A slight voluntary drooping of left lid emphasized in effort to see distinctly. Eyes show restriction of movements upwards and downwards. In extreme positions a rotatory nystagmus develops, the upper pole moving outwards in the slow phase, this is more marked in an attempted upward and downward movement; less on looking to right and to left. On attempting to turn eyes up, both eyes turn slightly to the left.

Pupils contracted; no reaction to light or accommodation; slightly irregular, left larger than right; left slightly springy at times. Deficient convergence. No hemianopsia (to finger tests). Optic papillitis in both eyes. Owing to the mental state of the patient it was impossible to test him for diplopia.

Agraphia in the right; cannot write with the right hand; clumsiness in the left.

Perhaps a loss of word memory. Shows occasional misuse of words, for instance, "What's your advisement to use that hand?" Calls second hand on the watch second time. Persists in so doing and does not seem to notice mistake though has previously called the larger hand the hands. Correctly names the balance wheel in the watch and also the crystal.

Blood examination normal. Urine normal. Wassermann reaction, negative.

March 19. Astereognosis in the right arm, for knife, coins, key, matches but not for a match box.

On March 18, 1916, I saw the case and made the following notes:

Right facial paralysis, not affecting eyes or forehead.

Right eye-slit slightly larger than left.

Eyes slightly deviated to left. In lateral positions has slight nystagmus horizontal, slow to mid line, more marked in left eye.

Eyes cannot be moved up or down, but move perfectly in horizontal plane to right and left.

Pupils contracted; do not react to light and so far as can be made out not to accommodation.

Caloric to left ear—cold water: Deviation well marked to left in both eyes; this is followed after a brief interval by a very slight movement to right which stops abruptly at mid-line. He cannot at this time move eye to right beyond mid-line. The chief phenomenon is the marked deviation to left. After a few minutes the deviation slowly disappears and the eyes can be moved to right.

Caloric to right ear—cold water: Rapid and well marked nystagmus in both eyes—slow to right, quick to left. Can move eyes to right and to left canthus, but not able to move eyes up or down.

The caloric reaction was rapidly produced. There was no vertigo or nausea.

There is here a labyrinthine reaction pronounced on both sides but interference with the cerebral phase on *left* side.

The outstanding points in this case are:

(1) The paresis of the Right VII, XII, right arm and leg with the corresponding reflex phenomenon of cerebral type, pointing to a lesion of the left pyramidal tract.

(2) The inability to move the eyes up or down; pupils contracted.

(3) No anesthesia.

(4) The non-involvement of

(a) the III nerve for lateral movement of the eyes.
(b) the levator palpebrae superioris.
(c) the upper facial (the orbicularis palpebrarum and corrugator supercilii).

In reference to this the following is of interest:—

"Mendel believes that fibres from the oculomotor nucleus are carried down in the posterior longitudinal bundle, and from this into the facial nerve, for the supply of the orbicularis palpebrarum and the corrugator supercilii, bringing these muscles therefore under the control of the same nucleus as the levator palpebrae superioris muscle. This view has received corroboration at the hands of Tooth and Turner" (Cunningham, D. J., Anatomy, 1902, p. 496). We have frequently seen jerking movements of the corrugator supercilii after labyrinthine stimulation and destruction in animals.

(5) No deafness.

(6) The caloric vestibular stimulation shows absence of the typical reaction. The slow deviation (labyrinthine phase) is not followed by the quick return phase (cerebral phase) when the slow deviation is towards the side of the cerebral lesion.

Complete explanation of this case is not possible for a postmortem examination was not obtained. Basing a diagnosis on the neurological findings and on the results of our experimental work, there is little difficulty in locating the lesion on the left side above the oculomotor nuclei involving the tegmental fibres, probably between the oculomotor nuclei and the temporal lobe.

The case is interesting in that it is so far unique and was foreshadowed by the experimental work part of which was here recorded. The explanation of the slow phase without the quick phase of nystagmus is due to interference with the cerebral path as we have outlined in our previous papers. The explanation of the impossibility of the eye to pass beyond the mid line appears to be that the ocular path for lateral deviation from the cerebral cortex consisting as it does of contraction of one muscle (or group) with re-

laxation of the antagonist is interfered with in some way and not able to counteract the labyrinthine deviation.

I believe such vestibular reactions are less rare than may be thought. A case of bilateral absence of the quick phase was reported by Maas (Maas, Neurolog. Centralblatt, 1913, p. 621), but with no postmortem date available.

Such cases are instructive to the neurologists in that they aid in the localization of lesions accompanied by more or less limitation in the upward and downward movements of the eyes. Spiller, (Spiller, Journal of Nervous and Mental Diseases, vol. 32, p. 432) who has paid considerable attention to this localization places such lesions in the vicinity of the oculomotor nucleus. How far this accords with our findings it would be out of place here to discuss.

Again it would be out of place here to discuss the bearing of these findings on the hypothesis that the red nucleus is the centre of the quick phase—a hypothesis chiefly supported by the Vienna School. The relation of the third nerve to the posterior part of the red nucleus appears to be against this hypothesis as expressed by them.

REPORT OF A CASE OF SYRINGOMYELIA WITH MARKED VESTIBULAR SYMPTOMS.

By G. E. SHAMBAUGH, M. D., Chicago, Ill.

An important chapter has been added to Otology by the recent studies in the physiology of the vestibular part of the inner ear and by the analysis of the symptoms arising from disease of this mechanism. The pursuit of these studies has led the otologist into an examination of the symptoms arising from disturbance of the central tract of the vestibular impulses and has thus brought his work into close relation with that of the neurologist. In making a diagnosis of intracranial lesions, the neurologist can often be assisted by an intelligent cooperation of the otologist.

In our studies of the vestibular mechanism we have already arrived at a satisfactory working basis for the interpretation of the symptoms arising from disease of the labyrinth, and for the diagnosis of the several forms of labyrinth disease. On the other hand, in the interpretation of the vestibular symptoms arising from disease of the central nervous system, and in diagnosis of these central lesions, we have made scarcely more than a beginning. We are still apparently on the threshold of what is to be a most valuable field for work. For these reasons it is still of great importance that cases should be reported where a diagnosis of disease of the central nervous system can be established, and in which there are distinct vestibular symptoms. These considerations have led me to report here the following case of syringomyelia producing symptoms arising from disturbance of the vestibular tract.

The case is that of a young man, age 28, a mining engineer, who was referred to me in September, 1915, because of disturbance of equilibrium and sensations of vertigo. He dates the onset of his difficulty two years ago, since when he has suffered most of the time from headache, chiefly occipital.

The disturbance of equilibrium consists of a sense of instability when walking, associated with some sensation of vertigo and occasional slight nausea. Ever since the onset of this trouble he has experienced much difficulty in reading. He discovered that in order to read at all it became necessary for him to hold the paper far over to one side. At the same time he would turn his face in the opposite direction. Only in this way, by making as strong a deviation of the eyes as possible, was he able to read. The side toward which the eyes had to be directed was not always the same, sometimes being to the right, at other times to the left. This change of sides often came on at short intervals. He would discover while reading with the book held over to one side, that the page became blurred, and that by holding the book over to the opposite side he would again be able to read. At no time had he noticed any tinnitus aurium or any difficulty in hearing.

In making an examination of his ears, the drum membranes were practically normal and the functional examination disclosed normal hearing in both ears. There was spontaneous nystagmus present on looking straight ahead. The eye movements were rather coarse and chiefly in the horizontal plane. The direction of the nystagmus was now toward one side, now toward the other, with but a few seconds' interval, during which the eyes would remain quiet. On deviation of the eyes toward the side of the quick component, the nystagmus became much more marked. Deviation of the eyes toward the slow component changed the character of the nystagmus. The movements became less marked and the quick component was directed toward the side of the deviation. It was found that his difficulty in reading was due to the violent spontaneous nystagmus and the deviation of the eyes, now to one side, now to another, while reading, was an effort to reduce to its minimum the ever present spontaneous nystagmus. For example, it was noticed that when the spontaneous nystagmus was directed toward the right, he would hold the book over to the left.

On making the rotation tests, it was noticed that when rotated toward the side of the slow component of the spontaneous nystagmus, this nystagmus was very much increased, and this increase seemed to last about a minute and a half before subsiding. When rotated toward the side of the quick component, the resulting after-nystagmus was much less violent and was directed to the opposite side. This after-nystagmus would usually continue about one minute before it would cease, and there would be a return of the pre-existing spontaneous nystagmus toward the opposite side.

Caloric stimulation, cold water, head erect, produced in either ear a ready response. The resulting nystagmus, while directed always toward the opposite side, differed from the normal reaction in that the character of the nystagmus was chiefly horizontal and only very slightly rotary.

The pointing tests also gave abnormal responses. The spontaneous pointing, shoulder from above, for both the right and the left hand was normal, irrespective of the existing spontaneous nystagmus. After caloric stimulation (cold) of the right ear, pointing for the right hand, shoulder from above, produced a deviation to the right of only four to five inches, while for the left hand there was no deviation at all. Caloric stimulation of the left ear (cold), shoulder from above, both right and left hand touches. Here, in spite of the marked nystagmus to the right, no past pointing to the left was produced.

Pointing tests after rotation also failed to give the normal past pointing. After rotation to the right, pointing shoulder from above, the right hand showed past pointing to the right of only four inches, while for the left hand there was no past pointing. After rotation to the left, no past pointing for either hand could be produced.

The absence of any hearing defect in this case and the fact that both rotation and caloric stimulation resulted in a prompt response from the vestibular apparatus, showed clearly that the vestibular symptoms did not arise from disturbance in the internal ear, but was due rather to some intracranial lesion. The shifting of the spontaneous nystag-

mus toward either side was also clearly not the result of a peripheral disturbance but could only be accounted for on the basis of some central disease. The failure to get the normal past pointing after stimulation of the peripheral mechanism by either caloric stimulation or after rotation was also clearly the result of some disturbance of the central tract of the vestibular impulses. In a case where there is no disease of the central tract, any disturbance of the peripheral mechanism which results in a disturbance of equilibrium is likely to produce spontaneous past pointing. This spontaneous past pointing will be toward the side to which the disturbance of equilibrium inclines the patient to fall. The past pointing will, in other words, be toward the side to which the slow component of the existing nystagmus is directed. For example, in a case where the disturbance of equilibrium is caused by the sudden suppression of function in one labyrinth, the tonus impulses from the opposite side, acting without the restraint of the normal tonus from the destroyed ear, will tend to throw the patient toward the affected side, and the slow component of the existing nystagmus will also draw the eyes toward the affected side. In the same way, while making the pointing tests in such a case, the arm will obey the same impulse, affecting all the other skeletal muscles, and there will be a past pointing toward the affected side. Again, when in a normal case we produce a disturbance of equilibrium by disturbing the normal flow of impulses from the two ears, whether by means of rotation or by caloric stimulation, the induced past pointing will be toward the side to which the patient is inclined to fall, that is, toward the side to which the slow component of the nystagmus is directed.

When we come to the cases of disturbed equilibrium resulting from diseases of the central tract of the vestibular nerve, the past pointing often fails to conform to the above simple rules. In the case here reported, for example, the existence of a strong spontaneous nystagmus failed to produce spontaneous past pointing as it would probably have done had the nystagmus been due to a disease in the peripheral

mechanism. Moreover, the stimulation of the peripheral mechanism by rotation and by cold water, while it produced a marked nystagmus, did not bring out the typical past pointing.

When it became clear that the disturbance in equilibrium in this case was the result of disease in the central nervous system and not of the peripheral mechanism of the labyrinth, I requested Dr. Thor Rothstein, a neurologist, to make an examination and determine the probable nature of the lesion. Dr. Rothstein discovered the case to be one of syringomyelia, with the extension of the lesion upward into the region of the fourth ventricle. The report of this examination is here appended.

Dr. Rothstein's Report.

The patient states that he has enjoyed good health up to two years ago, when his present trouble started to develop. Many years ago he had observed that he could stand without discomfort much hotter and colder baths than other people. Six years ago he noticed that pinching of skin did not cause pain over an area larger than the size of his hand and located on the left side, at the level of the heart region. Up to two years ago he was able to perform his work without any trouble, but at this time he started to become tired doing his work. He had to climb ladders in the mine, and this tired him more and more during the last two years, and his mother states that she noticed a marked change in him during the last two years. He is more easily tired and does not laugh as heartily as he used. Gradually some disturbance in walking has developed. He cannot handle his legs as easily as he used to, and he has some vertigo. Also it has become difficult for him to read. (See description of nystagmus.) He suffers at times from headaches, but they are never severe, and he also has some pain in the back when tired.

Physical examination: He is a well developed man and muscular. No paralysis of any muscles of the body exists. No atrophy of the muscles. Although he can walk, as it

seems, unhindered, the legs are slightly dragged and are kept adducted, but his steps are of about the normal length. With the exception of the nystagmus, nothing abnormal is found about the eyes, pupils reacting to light and accommodation and the eye grounds being normal. Triceps, radial and ulnar reflexes lively and present on both sides. Patellar reflexes increased. Ankleclonus slight on both sides. Plantar reflexes present. Babinsky reflex at times on both sides. Cremasteric reflex present. Abdominal reflexes lost on left side but present on the right. There is a slight resistance to passive movement of the legs, but this is not marked.

SENSATION.

Sensation to Touch.

Right Side of Body: Sensation to touch is normal.

Left Side of Body: Sensation to touch is considerably decreased, but not entirely lost, over an area extending between the level of the mammila and the level of the lower border of the thorax. It is less markedly decreased between this last level and the level of the crista ilii, and only slightly decreased over the area innervated by the second and third lumbar roots. On the rest of the left side of the body sensation to touch is normal. The decrease in sensation to touch is found both anteriorly and posteriorly.

Sensation to Pain.

Right Side of Body: Sensation to pain is normal.

Left Side of Body: Sensation to pain is lost entirely over an area between the level of the mammila to level of the lower border of thorax. It is markedly decreased over the area between the level of the lower border of the thorax and crista ilii and over the area of the second and third lumbar roots. It is also slightly decreased between the level of the mammila and the level of the clavicula. The decrease in sensation to pain is also found both anteriorly and posteriorly.

Sensation to Temperature.

Right Side of Body: 24°C is felt cold all over right side, but sensation to warmth is markedly decreased over an

area between the level of the clavicula and lower border of thorax, and also decreased over ulnar half of right arm and hand.

Left Side of Body: Sensation to temperature is practically lost over whole left half of trunk, with the exception of above level of second rib. It is markedly decreased over the area of second and third lumbar roots and ulnar half of left arm. The sensation to temperature, furthermore, is not quite normal on the neck and back of head, but is normal over area innervated by trigeminus.

Wassermann on blood and spinal fluid is negative. In spinal fluid were found 7 cells to mm3. Nonne test negative and Lange test negative.

Conclusions.

It is evident that a long-standing disturbance and sensation to temperature (See history), the present marked disturbances of sensation to temperature and pain, and the much less marked disturbances of sensation to touch, makes a diagnosis of syringomyelia the only one possible. The condition of the reflexes, as well as the slightly marked motor disturbances, conform well to this diagnosis. The history and the condition of the spinal fluid excludes syphilis. The decrease in sensation to temperature over the neck and back of head, demonstrates that this syringomyelic process has reached up to the medulla oblongata. It is therefore quite natural to assume that the nystagmus in this case depends upon an extension of the syringomyelic process up into the region of the 4th ventricle (Syringo bulbia). Nystagmus has been described in syringomyelia by many authors (Grund, Thomas, Monro, Koeliechen, McLaren, Barany, and others), and in some cases as the only present supra medullary symptom. In Barany's cases (two) there existed strong spontaneous nystagmus, but without inhibition of the reaction of the vestibular apparatus in regard to nystagmus.

Discussion.

Dr. E. B. Dench, New York City, referring to Dr. Wilson's first case, in which the watch was heard better than the voice, had seen a good many cases in which this symptom had been found. He had always regarded them as due to a lesion of the auditory nerve trunk. He saw two or three cases a year, perhaps, in which the tone limits were normal, caloric was normal, and yet the patient was deaf. He thought the symptoms might be due to edema or some similar condition around the nerve. In some cases it was due to a tumor. Referring to the second case, he had seen cases in which the vestibular disturbance of the labyrinth was greater than the cerebral, as shown by the slow-component nystagmus on stimulation of one labyrinth. He wondered if some of the cases of vertigo were not due to this. He recalled one case in which it was due to high blood pressure. In Dr. Wilson's case, the blood pressure might have interfered with the cerebral component. He recalled the case of a woman at St. Luke's Hospital who had an over-pointing test, the condition probably being due to multiple sclerosis. That point was brought out very clearly by the otological examination. Referring to Dr. Shambaugh's case, he was reminded of the striking lack of uniformity in the findings of different examinations in a given case, nystagmus, for example, being found one day and not found another. The field of the otologist was constantly overlapping that of the neurologist.

Dr. Wells P. Eagleton, New York, N. J., said that for so many years otologists had been interested in the labyrinth, and before that in the middle ear, and had forgotten the much more important part,—the central apparatus. Reference to the older records would show that cases of cerebellar-pontine tumors presented themselves early to the aurist who treated them as aural conditions. Hollinger, of Chicago, before the International Otological Congress at Boston, had called attention to the diagnosis of this in connection with

the tuning fork tests. He called attention to one point in Dr. Wilson's paper,—the loss of hearing in involvement of one side of the brain. In abscess of the temporosphenoidal lobe of the left side there would be involvement of hearing on the opposite side for the first few days, which would then disappear. This symptom he had observed in several cases of temporosphenoidal abscess. He emphasized the importance of increased intracranial pressure in the modification of the vestibular reaction, and its variability in cerebellar growths. A few years ago he had reported three cases of the results of decompression on both the hearing and the vestibular apparatus. In one the hearing and the vestibular reaction were perfectly restored. In the two others the hearing had been restored.

Dr. Isaac H. Jones, Philadelphia, was pleased to find that Dr. Wilson's experimental work agreed with the findings in a case which had recently come under his observation. Woman age 36: history of vertigo without associated tinnitus; 8 weeks standing. Two weeks after onset, vertigo was so marked, she was not able to walk. Ear tests showed:

(1) Douching the right vertical canals gave no reactions whatever. The right horizontal canal caused a *conjugate deviation* of the eyes to the right. The left vertical canals and also the left horizontal canal produced a conjugate deviation to the left. The *absence of the quick component* suggested lesion at the lower portion of the junction of the cerebral crura, where the fibres from the cerebral cortex of both sides enter the posterior longitudinal bundle.

(2) All the semicircular canals failed to produce normal vertigo. This suggested lesion at the *same point* in the decussation of the superior cerebellar peduncles at the base of the cerebral crura. We consider that the fibres from the horizontal semicircular canal pass through the inferior cerebellar peduncle to the cerebellar nuclei and continue out through the superior cerebellar peduncle in which they decussate to the cerebral crus of the opposite side and to the cortex of the temporal lobe. This is the pathway responsible

for *vertigo* from stimulation of the horizontal canal. The fibres from the *vertical* semicircular canals have a different pathway. After entering the brain-stem they ascend in the pons and enter the cerebellum through the *middle* cerebellar peduncle; from the cerebellar nuclei, their pathway is the same as the horizontal canal fibres, from the cerebellar nuclei to the cerebral cortex. Now in this case, the only lesion that could involve the fibres from all canals must necessarily be at the decussation of the *superior* cerebellar peduncle.

Dr. William G. Spiller reported that the macroscopic and microscopic examination confirmed the ear report and showed a glioma at the junction of the cerebral crura extending down into the pons. Evidently it was this extension into the pons that had involved the fibres from the right vertical canals which had failed to produce any responses.

The point of particular interest is that all the data—the absence of the quick component, the impaired vertigo and the failure of all responses from the right vertical canals—all placed the lesion at one definite point.

Dr. Shambaugh's report shows how essential it is that the Barany tests should be thoroughly carried out in every intracranial case.

Dr. Shambaugh, in closing the discussion, called attention to the importance of co-operation between the specialist in Otology and men working in internal medicine and neurology. There are many cases where the opinion of the internist and neurologist can be of great assistance to the otologist. It is as great a mistake for the otologist to assume responsibility for the interpretation of the symptoms arising from obscure intracranial conditions as it is for the neurologist to assume the responsibility of interpreting the significance of symptoms arising from a lesion of the ear. He agreed with Dr. Dench that the symptoms presented in the first case Dr. Wilson reports might be accounted for from some involvement of the 8th nerve, rather than disease of the brain itself.

EMBOLIC PNEUMONIA FOLLOWING THE MASTOID OPERATION; REPORT OF THREE CASES.

By GEORGE L. RICHARDS, M. D., Fall River, Mass.

During the last year I have had three cases showing, after the mastoid operation, symptoms of what has apparently been an embolic infarct of the lung, localized and limited, with the early symptoms of a pneumonia and with an accompanying pleurisy of the same character. I am wondering if cases such as these are not fairly common, and whether the possible occurrence of localized mural thrombi of the lateral sinus should not be considered in the after handling of our mastoid cases, even when the classical picture of sinus thrombosis is entirely absent.

Case 1. R. W. J. Physician. Acute otitis media in right ear June 14, 1915. Incised under ethyl chlorid. Relief Purulent discharge. June 15th, pain; June 16th, better; June 17th, pain. Incised drum again, ethyl chlorid anesthesia. No relief from the pain which continued in spite of free discharge, and on June 20th the X-ray showing involvement of the right mastoid, the usual operation for an acute mastoid was performed. The X-ray findings were confirmed, extensive involvement of all the cells being found. The day following he complained of acute indigestion and nausea. June 21st, temperature 100° to 102°; June 22d, temperature 101° to 101.2°; June 23, temperature 101.6° to 104°. On this date the high temperature was explained by the appearance of definite erysipelas extending backwards, forwards and upwards from the mastoid area. At this time Dr. George L. Tobey, Jr., of Boston saw him in consultation, the question of sinus thrombosis being under consideration. As there were no chills, the appearance of the erysipelas served in our minds to explain the temperature which became normal on June 28th. From June 23d to the 27th there was steady disturbance of the stomach and inability to sleep. Aside from

this convalescence was continuous. On July 1st, by his own insistence, and not by advice, he went home from the hospital. On July 4th, after having felt very well for the preceding two or three days, he had a sudden attack of pain in the right lung just below the nipple, accompanied by a temperature of 101° running up to 102.5° and the spitting up of some bright blood. A diagnosis was made of a localized pneumonia. On July 14th, the twenty-fifth day of the disease the temperature became normal. On July 20th there was a similar attack in the opposite lung in about the same relative position, and running clinically almost the same course as to temperature and duration, the latter being about four days. From this time onward convalescence was uneventful. At the time it was first considered, did or did not this patient have a mural thrombus of the lateral sinus, a portion of which on two different occasions was later detached, producing an embolic infarct in each lung with a resultant localized pneumonia.

Case 2. W. A. came under observation on July 13th, 1915, for an acute otitis media. An incision in the drum was made under ethyl chlorid anesthesia resulting in immediate relief, but three days later pain re-occurred and a second incision was made. On July 19th an X-ray picture showed involvement of the left mastoid. He was admitted to the hospital on July 21st and on July 22d an operation for an acute mastoid was performed, the patient taking ether rather poorly. The history in the hospital was uneventful from the 22d to the 29th, the temperature not going above 99.5°, and on the latter date he was sent home at his own request. Three days later, August 2d, he had a sharp pain in his left side, and the diagnosis of pleurisy was given by the attending physician. I did not see him at his home until several days later. Inasmuch, however, as the pain was sharply localized and the attack of rather short duration, in the light of the other two cases here reported, I think he had an embolic pneumonia. Recovery was complete, but it was several weeks before the pain in the side had entirely disappeared.

Case 3. P. H. Male, fifty years old. Sept. 25, 1915, acute otitis media. Drum incised under ethyl chlorid. Sept. 26th

X-ray picture showed mastoid involvement but he refused operation until Sept. 30th when the entire mastoid area was found filled with pus and broken down cells. On the day of admission to the hospital the temperature was 99° and on the next day 101° to 102°. In the morning of October 2d he complained of a sharp pain in the left lung very decidedly limited and with all the characteristics of embolic pneumonia. There was bloody sputum for a few hours, then frothy. The rest of the lung on each side was free from trouble. The convalescence was uneventful and he was discharged on October 10th.

Remarks: In all of these cases there was a sudden attack of pain which on physical examination appeared to be due to shutting off of a portion of lung, that is, to be the result of an infarct following an embolus and with an accompanying pleurisy. Just such symptoms and just such physical signs as might be expected to follow the lodgement of a small mural thrombus from the lateral sinus and its passage down to the right side of the heart and thence into the lung. In all three cases the trouble appeared on the side of the operation and that side only, with the exception of the first case where both sides were affected, the side of the operation first. There was no uniformity in the time area, the attacks coming in respectively two days, eleven days, twenty-two and twenty-eight days. In each instance, ethyl chlorid had been used as the primary anesthetic. Had this anything to do with the case? I think not.

A CASE OF SEPTIC THROMBOSIS OF THE JUGULAR BULB WITH REPEATED FORMATION OF SEPTIC THROMBI IN THE SIGMOID AND LATERAL SINUSES, WITH REFERENCE TO THE LITERATURE ON INVOLVEMENT OF THE TORCULAR HEROPHILI IN SUCH CASES.

By JOHN RANDOLPH PAGE, M. D., New York, N. Y.

The proximity to the torcular Herophili of the final thrombus which formed in this case, and the cause of its limitation at this point has brought to mind some conflicting views regarding the tendency of a thrombus in this region to extend across the torcular to the opposite side. The discussion of this subject by Mr. Ballance and Mr. H. E. Jones, Senior Surgeon of the Liverpool Eye and Ear Infirmary, will be referred to later.

A delicate girl, 12 years of age, developed an abscess in her right middle ear, upon which a myringotomy was performed the following day. The third day after the myringotomy she had a chill, and her temperature rose to 103.8° by mouth.

The following day I saw her and advised immediate mastoidectomy. Nothing unusual was found beyond a well infected mastoid, but because of the chill on the previous day and the septic appearance of the child, a guarded prognosis was given, and the precaution was taken to remove the plate over the vertical limb of the sinus for inspection of its wall. It was apparently normal but the possibility of infection being in the bulb was remarked at the time.

The patient being operated on out of town was left in the care of Dr. Kellogg, of Norwalk, Connecticut, who reported the following morning that the temperature had risen to 106.5° during the night, but that the condition was then good, temperature at noon being 99.8°. In the afternoon after a chill the temperature rose to 107.5°.

Exploration of the sigmoid sinus that night revealed scant

bleeding from the bulb, but no clot in the vein and no apparent change in its wall. The internal jugular was resected and the lower portion of the sigmoid sinus wall cut away.

A fall in the temperature to 98° accompanied by an alarming collapse followed three hours after the jugular resection. Next day, however, the child's condition was fair and spirits good, but the following night the temperature rose to 107.2° and the next night to 105.5°. After this her condition improved, but at the end of a week signs of sepsis began to return.

On the 12th day after the jugular resection a large abscess was opened in the upper part of the vertical limb of the sinus. The sinus wall was excised beyond the clot and free bleeding was obtained. Culture from the pus showed streptococcus hemolyticus, blood culture was negative, leukocytes 20,000, 92% polynuclears. She now complained of blurred vision. A distinct double optic neuritis was present, more marked on the right side. The disturbance of vision apparently subsided in a few days; and no further opthalmoscopic examinations were made.

Immediate improvement followed this operation, but within a week a return of the high temperature and sepsis made further exploration of the sinus in the direction of the torcular necessary.

Because of the patient's extreme weakness, the operation had to be performed in bed without an anesthetic. More bone was removed and the sinus further exposed for about 2 c. m. Incision of it released another drachm of thick gray pus from its interior. Gentle removal of the torcular end of the thrombus was made with forceps and a good flow of blood was obtained, which flushed out the vein. Iodoform gauze was then introduced into the lumen of the vein for one inch or more with the hope that the clot might be induced to form beyond the area of infected wall. This was followed by marked improvement for six days. On the seventh day, signs of sepsis reappeared and a fourth exploration of the sinus still further back was necessary.

At this operation (under ether) an abscess, similar to the other two was found, the sinus being filled with dark gray pus, which extended back to within three c. m. of the posterior occipital protuberance. There were no granulations on the wall, but it had an infected appearance. The clot in the vein which extended beyond this point, was removed with forceps, and the bleeding which followed its removal was controlled by my finger in the vein. With my finger in the vessel for two or more centimeters, I could feel a septum which seemed to divide its lumen at the torcular.

Feeling that the vein wall might be infected to this point, I inserted iodoform gauze as far back as my finger reached and later felt fearful lest it might produce a thrombus in the other sinuses. This gauze was removed on the second day and its removal was followed by a surprisingly small flow of blood due probably to a partial thrombosis of the superior longitudinal sinus and a naturally small communication with the sinus on the opposite side.

During the progress of the case, which after this operation made an uninterrupted recovery, Dr. John D. Richards expressed the opinion that the thrombus would not extend to the opposite sinuses of the torcular, as the rapid flow of blood through them at this point would tend to limit the formation of the clot.

In this opinion he is supported by Mr. Ballance,[1] who, in 1890, made the following statement: "It is an error to suppose that the lateral sinuses are continuous at the torcular Herophili; the right sinus is continuous with the superior longitudinal sinus and the left sinus is as a rule a continuation of the straight. There are sharp bends in the venous channels where the lateral sinus commences and these are joined across the front of the internal occipital protuberance by means of a separate sinus, or cross branch, of small size; thus a thrombosis of one lateral sinus need not, and probably will not, be accompanied by thrombosis of the other lateral sinus, and so life is spared." While the above arrangement is not invariable it will be found to be the general rule.

Cunningham states.[2] "That the superior sagittal sinus turns to the right and becomes continuous with the right transverse sinus, while the posterior end of the straight sinus turns to the left and joins the left transverse sinus. In a certain number of cases this arrangement is reversed, and *not uncommonly* there is a communication between the right and left transverse sinus across the front of the internal occipital protuberance." He then says, that "*Occasionally* the superior sagittal, the two transverse sinuses, the straight sinus, and the occipital sinus unite anterior to the occipital proturberance in a common dilation the 'confluens sinuum.'"

Despite the fact that this last arrangement is the most infrequent of any, it seems, from the descriptions given of operations on the transverse sinus in this region, the one thought to be most common. This very general impression has been due to the meager descriptions of the text-books on anatomy which refer to the torcular Herophili only as a marked dilatation of "irregular form" where the five sinuses meet.

In regard to the complete separation of the two sides, Dwight[3] says, in a discussion of the subject, that he "Cannot agree with Rüdinger that complete separation of the two parts of the torcular is common, this and perfect symmetry being about equally rare." The right lateral sinus is usually considerably larger than the left, and the symmetry may extend to complete absence of one lateral sinus and jugular vein as has been referred to by Eagleton[4] and others.

Hugh E. Jones[5], senior surgeon of the Liverpool Eye and Ear Infirmary, is of the opinion, contrary to Mr. Ballance, that "Once at the torcular the progress of infection to the other great sinuses is easy," and that the question of extension of infection to the opposite sinus has not received the attention it deserves in literature. He supports this opinion by reference to a case reported by himself, a remarkable one by Whitehead[6], and one by Lodge; but with the exception of Whitehead's case the others appear to me not to have been due to gradual extension of the thrombus from one sinus to that of the opposite side, but to the formation of a

clot shortly before death in the whole region of the torcular, due, in all probability, to the general condition of the patient rather than to a true extension of the septic thrombus from the lateral sinus; for while thrombosis of the whole region of the torcular and all the sinuses has been repeatedly reported in cases profoundly septic and debilitated from various causes, so far as I have been able to ascertain the literature records few cases in which a truly septic thrombus extended from the mastoid region of one side across the torcular to the opposite side.

The extension would naturally take place only to that sinus of which the one involved was a continuation, and because of the usual separation, except for the rather variable communication between the two sides, it would not be likely to extend to the other side.

An example of this is prettily demonstrated in a case reported by Dr. Simpson[7] in which the mastoid and lateral sinus of the left side had been operated on. Autopsy showed "The superior and inferior longitudinal sinus to be patent and without change, the left lateral sinus completely occluded, a thrombus extending from the point of operation at the left mastoid to the torcular Herophili and also to a slight extent into the straight sinus. The right lateral sinus was quite free and healthy."

In the case referred to by Mr. Jones[8] the autopsy report says, "From the junction of the superior petrosal sinus with the lateral sinus up to within one-half inch of the torcular Herophili *the walls of the sinus were healthy,* but here commenced a patch of phlebitis one inch long, etc., etc., which extended across the midline to the superior longtitudinal sinus and right lateral sinus." It will be seen from this that there was not an extension from the original thrombus in the sigmoid, but that one formed spontaneously in the torcular, due probably to the extremely septic and weakened condition of the patient.

In another article[6], in opposition to Mr. Ballance, he cites the twenty-two cases of lateral sinus thrombosis associated with ear diseases, collected by Newton Pitt,[9] in which the

clot extended to the longitudinal sinus in four, to the opposite lateral in three, and in one to all the sinuses, and says that, "Not only, therefore, is it a not unlikely occurrence, but a comparatively common one." Again we think his conclusion unjustified for it will be seen from this collection of Pitt's that in four cases the clot extended to the longitudinal sinus (a continuation of the right lateral) and not to the opposite side, so while this leaves four to be accounted for it cuts down his percentage by half. And among these we are not convinced that there were not some similar to the one he reported in which the thrombosis was due to general causes rather than to a real extension from the primary thrombus in the mastoid region.

If I may be permitted to cite one more reference, Lidell,[10] in 1874, collected thirteen cases of sinus thrombosis associated with mastoiditis in which autopsies were performed, and in one of these there was extension a short distance into the opposite side. The report says, "A light colored, purulent looking plug distended the right lateral sinus and adhered closely to its walls—the same clot filled the torcular Herophili also and extended *a little way* into the left lateral and straight sinuses. The posterior two-thirds of the superior longitudinal sinus was filled with greenish pus which also extended to the veins coming from the pia on the right side."

This report to my mind supports Mr. Ballance rather than Mr. Jones, for the superior longitudinal sinus was, no doubt, continuous with the right lateral in which the trouble began and two-thirds of its length became involved before the torcular was crossed and the opposite lateral and straight sinus were involved even for "a little way."

In Whitehead's very exceptional case, which recovered, there was no doubt of the involvement of both sides of the torcular.

After operation on the right mastoid, he says: "The sinus was freely exposed and found to be thrombosed; the overlying bone was removed back to and over the torcular Herophili and the sinus laid open the whole distance; the openings of the longitudinal sinus and of the lateral sinus

of the other side were blocked with firm clot, and a small curet passed into the opposite sinus failed to set up bleeding." Such cases are very rare.

While we not infrequently hear of a thrombus being encountered which extends from the torcular to the bulb and occasionally a case in which no bleeding is obtained from the torcular region, no minute descriptions are given of the operations in this region, and I think it will prove interesting to observe as often as possible in the living, and at autopsies, just what direction and to what extent lateral sinus thrombosis progresses in this region. It will be interesting also to note more carefully in future the variations in the anatomy of this interesting meeting place of the sinuses.

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Discussion.

Dr. E. B. Dench, New York City, thought mastoid cases were not allowed out of bed too soon, judging from the small number of cases of these complications. He allowed his patients to get out of bed in three days and to go home in ten days, and he had not seen any such complications as had been mentioned by Dr. Richards. Referring to Dr. Page's case, he recalled having lost two cases in which, at autopsy, it was found that the clot went back to the torcular.

Dr. Wendell C. Phillips, New York City, emphasized further the point raised by Dr. Richards and mentioned by Dr. Dench, regarding the time of getting the mastoid patient out of bed. In uncomplicated cases he tried to have the patient sitting up in bed on the fourth day, sitting in a chair on the fifth or sixth, and leaving the hospital on the eighth or tenth day.

Dr. Emil Amberg, Detroit, Mich., asked Dr. Richards if the anesthetic, in his case, was given with the patient sitting up, to which a negative reply was given. He suggested that an infection might have taken place by aspiration in an area irritated by the anesthetic. He considered the presence of an infarct a very remote possibility.

Dr. Ewing W. Day, Pittsburg, Pa., had never seen complications such as those suggested by Dr. Richards, and he got his patients out of bed early, and discharged them from the hospital in from five to six days.

Dr. Charles W. Richardson, Washington, D. C., thought the case simulated one of parietal clot of aspiration pneumonia. He did not see why thrombosis in the lungs should not follow ear operations as well as operations on the nose, sinuses and tonsils.

Dr. Max A. Goldstein, St. Louis, Mo., could not gather, from Dr. Richards' report of the case, that the localized lung lesion was pathologically identified with parietal clot.

Dr. Richards, in closing the discussion, reiterated that the attacks came on in periods varying from two days to two weeks. It seemed to him that infarcts were developing in the lung, but where they came from he did not know. The attacks were relatively short, and might occur when the patient was not under observation. He felt that the question of how long to keep mastoid patients in bed should be given careful consideration. Would it not be better to keep them more quiet than had been the custom? In two of the four cases myringotomy was performed by his assistants, was not satisfactory, and was repeated. All the cases recovered and were back at work.

Dr. John B. Rae, New York City, agreed with Dr. Richards that his cases were really sinus infections, although this was incapable of actual proof. The mere absence of positive blood cultures in such cases does not preclude the diagnosis, nor does the fact that the patient recovers. He himself had had a similar experience during the winter. The patient was a woman of sixty-five years and was suffering from an acute mastoiditis following grippe. The post-operative temperature was normal for a week when the patient was discharged from the hospital. Within forty-eight hours after discharge she had a marked chill with rise of temperature to 104°. Within the next few days four chills occurred, each less in intensity than the preceding one and each followed by a rise in temperature but to a less degree. Four blood cultures proved negative, repeated blood counts showed nothing of significance and all other laboratory tests proved negative, as also did examination by an internist. On one occasion she complained of pain in the lung and expectorated some blood, but no physical signs of consolidation could be determined. The question of exploring the sinus was very naturally discussed, but in view of the age of the patient, the diminution in the severity of the chills, the gradual recession of temperature, the negative blood cultures, and other negative findings, this was not done, and the patient

went on to complete recovery. In spite of all this, one can hardly escape the diagnosis of parietal clot.

Dr. Page in closing the discussion said he thought that in extreme cases before death occurred the infected thrombus might extend to the opposite side, but that it seemed hardly possible to him for such a case to recover, for even if the sepsis were survived extention to the opposite side would mean fatal interference with the flow of venous blood from the brain by the blocking of both lateral and both longitudinal sinuses, superior and inferior, and the straight sinus.

INVOLVEMENT OF THE LABYRINTH BY WAY OF THE DUCTUS ENDOLYMPHATICUS.

By NORVAL H. PIERCE, M. D., Chicago, Ill.

Reports of cases of infection of the saccus secondary to labyrinthine suppuration are very numerous, the labyrinth, in such cases, being involved through a fistula of the horizontal semicircular canal, the fenestrum ovale, or the promontory. The inflammatory process, spreading to the ductus cochlearis, thence through the ductus endolymphaticus, invades the saccus, and there forms a larger or smaller accumulation of purulent material.

This has been thought to be one of the paths by which cerebellar abscess may originate, but most frequently the end result is a sub- or intradural abscess, as the sac has a far greater tendency to burst toward the bone than toward the arachnoid space.

Involvement of the labyrinth, secondary to inflammation of the saccus or by way of the ductus endolymphaticus is very difficult to prove postmortem; the literature on the subject is therefore very meagre. Cases have been reported in which there has been found no demonstrable fistula in any of the semicircular canals, the footplate of the stapes, or the promontory, and in which the labyrinthine suppurative process has eventuated in fatal meningitis, the saccule having been proved, microscopically, to have been involved directly from the bone upon which it lays, this having become softened in the course of an acute or chronic mastoiditis, or in the course of a sigmoid sinus thrombosis.

During the last five years I have had two cases, both of them having about the same characteristics, which were as follows: Acute mastoiditis, following an attack of acute otitis media. After subsidence of the initial otitic symptoms in the course of a month they displayed temperature, more or less constant; absence of marked external tenderness and infiltration, but headache, corresponding to the side of the ear in-

volved; marked decrease in bone conduction; a slight decrease in air conduction, giving a positive Rinné; marked lowering of the upper tone limit, with preservation of the lower tone limit; nystagmus, rotary in character, to *both* sides,— that is, to the sound and the diseased side,—when the eyes turned in these directions. The static labyrinth responded to the caloric tests; there was no stiff neck, no Kernig, no Babinski; but the spinal fluid was somewhat turbid, the cell count being increased from 200 to 500 per c. m.

In the course of a simple mastoid operation marked softening of the temporal bone upwards and backwards was found. In both cases the tegmen antri could be removed with a sharp spoon. As far as could be ascertained upon the table, there was no fistula leading to the superior or longitudinal semicircular canal.

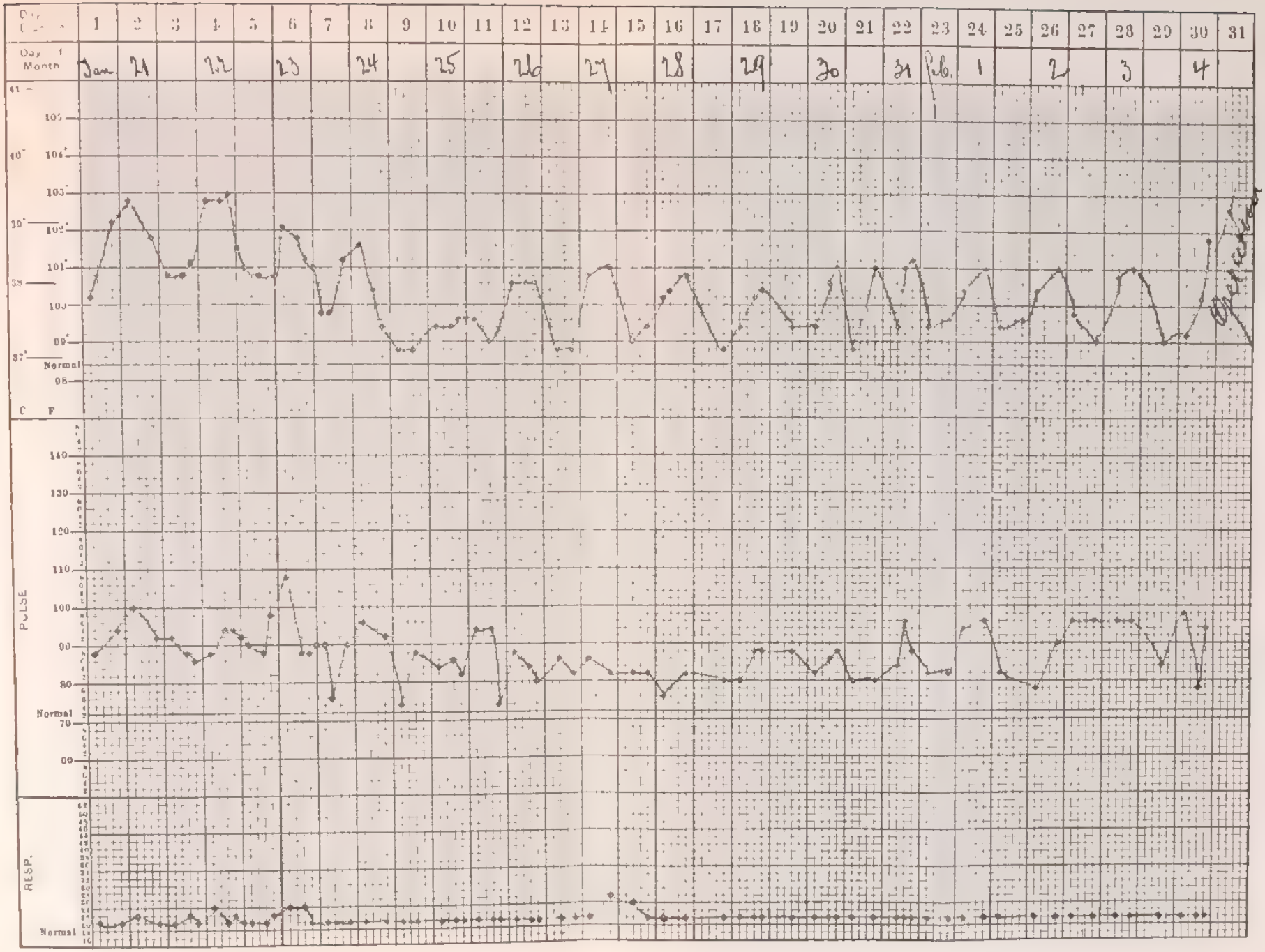
The cases followed the usual course of healing, without any further disturbance, the meningeal tension ceasing in the course of three or four days, the nystagmus disappearing at the end of a week.

In my own mind I had explained these symptoms of labyrinthine irritation by assuming that the inflammation of the dura had spread down to the eighth nerve, and had caused the irritative symptoms of the static apparatus.

A recent case, however, has thrown some light on the subject. While, as in the two cases previously mentioned, the third resulted in recovery, thus excluding autopsy proof, the strong presumptive evidence would seem to indicate that the saccus endolymphaticus may have been involved in a plastic inflammation, producing severe disturbance of the labyrinth and symptoms of beginning meningitis. I will briefly relate the history:

As a preface I might state that Wassermann test (3.3.16) was negative, as was the Wedal test and blood cultures.

Mr. E. O. B., lawyer, 36 years of age, entered St. Luke's Hospital, January 21, 1916, on the service of Dr. Theobald. On January 8, the patient had suffered from a severe earache, on both sides, which followed an attack of grippe beginning January 1. This was probably the first trouble he had ever


Day of Month
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Jan 21 22 23 24 25 26 27 28 29 30 31 Feb. 1 2 3 4
105
104
103
102
101
100
99
98
Normal
F
PULSE
140
130
120
110
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90
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Normal
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60
RESP.
Normal

Day of Disease
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Day of Month
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RESP.
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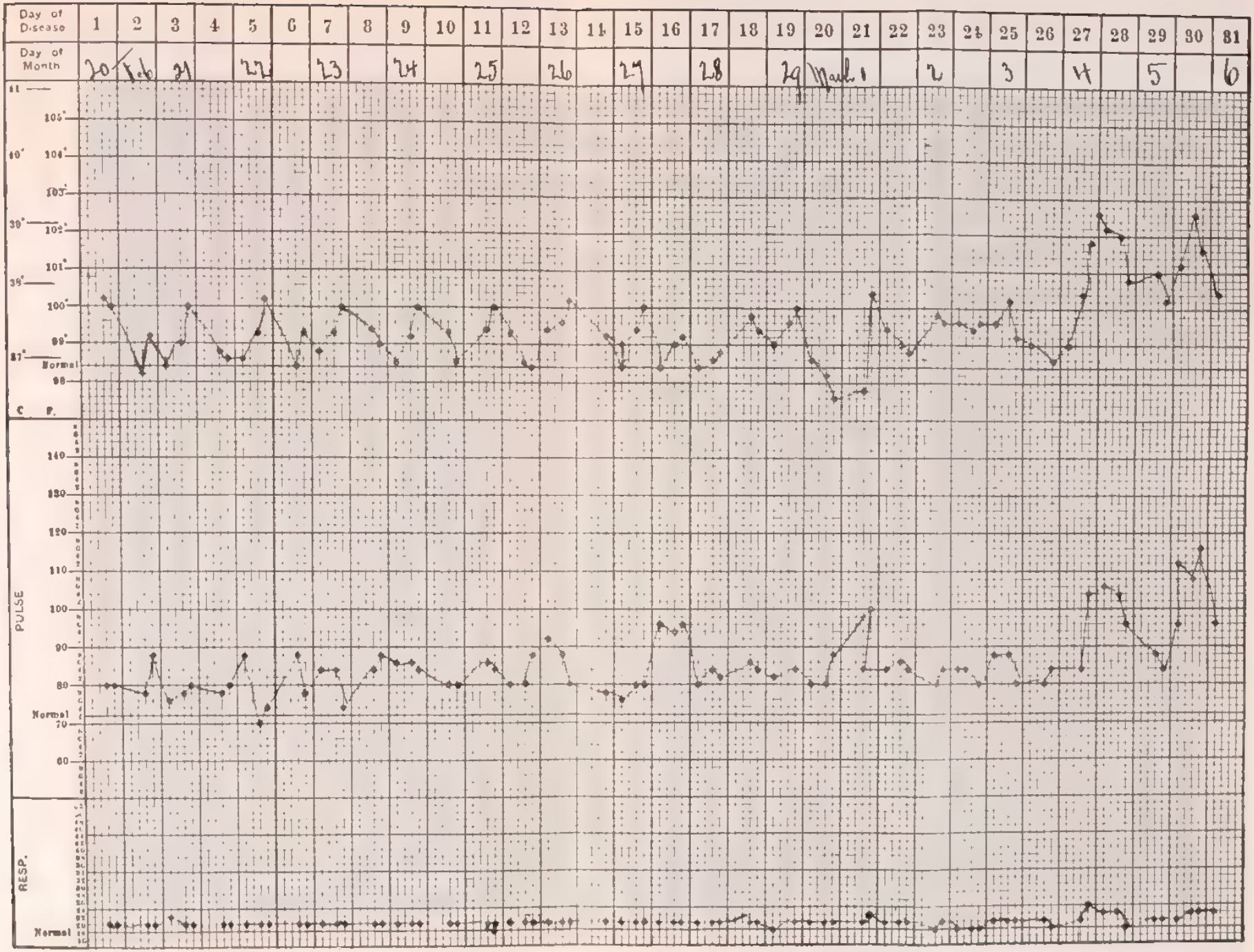
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PULSE
140 130 120 110 100 90 80 Normal 70 60
RESP
Normal

Day of Disease
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
Day of Month
22 Mar. 23 24 25 26 27 28 29 30
Normal
C. F.
PULSE
Normal
RESP.
Normal

had with his ears. Paracentesis was performed on both ears two days after the onset of the trouble.

He had had scarlet fever, the usual diseases of childhood, and chronic ethmoiditis. Family history negative. He was a thin, pale man.

There was no pain on pressure over the mastoid; there was a purulent discharge, considerable in amount, from both ears. The blood count was 8,400 white, 68 per cent. polymorphonuclears. The temperature ranged from 100° to 102.6°. Sugar and albumin absent; microscopic examination negative.

The ear was packed with gauze, and a fifty per cent. alcohol dressing applied. The temperature chart is displayed herewith, and may be consulted by those who wish to see for themselves.

While the temperature improved, the discharge continued until February 1, when the temperature began again to mount up. The patient then complained of headache; had sleepless nights; his general condition was less favorable than when he entered the hospital; his tongue was furred; he was constipated. There was a trace of albumen in the urine. In spite of the absence of mastoid swelling, and of tenderness and pain over the mastoid and that X-ray plates taken at this time showed nothing definite, I advised operation.

In pursuance of this advice, on February 4, I opened both mastoid processes, under gas. There was a small amount of pus in each mastoid, in the region of the tip cells. There was no fistula in either external semicircular canal, but on the right side I found an area of softened bone, which could be easily removed with the curet, extending inward and backward around the region of the labyrinth, to a point above the upper border of the sigmoid sinus. The meninges were uncovered to the extent of about one-half centimeter. The dura looked hyperemic and slightly thickened.

The patient did not do very well after the operation. The various laboratory examinations will be found elsewhere. If you will consult the temperature curve, you will find that the temperature did not return to normal, but continued for

some days to range from 100.5° to 99° and 98.8°. On February 13 the temperature was normal, the wound discharged freely, and there was a discharge from the external auditory canal. On February 17 the temperature began to mount to 100° and 100.5°.

He ran along thus until March 1, when he complained of a sensation of dizziness and of being nauseated. The temperature on this day varied from 98.6° to 101°. The dizziness, nausea and vomiting increased during the day, so that he was unable to change his position in bed, but remained on his left side. Every attempt to change his position resulted in a violent attack of vomiting, accompanied by diaphoresis.

When I saw him the next day he had a violent nystagmus of the third degree to the left. The right static apparatus did not respond to caloric test, and he was unable to hear a Bezold small a 1 fork when the noise apparatus was held in the left ear. He complained a good deal of deafness, headache, and indefinite stiffness about the neck. There was no Kernig and no Babinski, but there was marked photophobia. Pus from the ear showed hemolytic streptococcus; staphylococcus albus. On March 6, spinal fluid showed Nonne strongly positive; Lange positive; cell count 95 per c. m.; culture negative; no sugar. On March 8, Nonne strongly positive; Ross Jones strongly positive; Lange positive; cell count per c. m., 973; polymorphonuclears, 95 per cent.; cultures negative; sugar negative. The blood count throughout is given below:

(See page 177)

In the left ear he complained of great tinnitus. The audition in this ear was also very much impaired, but it responded to caloric stimulation. The trouble was evidently in the right labyrinth, and the laboratory findings indicate a beginning meningitis. At this time the labyrinth operation was very seriously considered. The temperature, March 6, was 102.6°. However, on the following day his general condition seemed to be a good deal improved, the pain in the head had subsided, the temperature was lower, and the dizziness and vomiting were markedly less.

From this time on, with the exception of a few days, when there were occasional pains in the left ear necessitating the opening of the drum-head, he continued to improve. He was discharged March 27. He is now performing his duties. An examination, just before I left home, showed that he could hear the small a 1 fork, could distinguish spoken numerals about two feet from the right ear, with the noise apparatus in the left, demonstrating that function was returning.

EXAMINATION OF BLOOD.

	Quantitative.	*Differential Count.*
1/21/'16.	Leucocytes per c. m.....8,400	Lymphocytes:
		(a) Small 23
		(b) Large 4
		(c) Indentate Nucleus .. 3
		Neutrophiles:
		(a) Polymorphonuclear .68
		Eosinophiles:
		(a) Polymorphonuclear . 1
		Basophiles 1
1/22/'16.	Leucocytes per c. m.....11,700	Lymphocytes:
		(a) Small 16
		(b) Large 6
		(c) Indentate Nucleus .. 1
		Neutrophiles:
		(a) Polymorphonuclear 75
		Basophiles 2
1/23/'16.	Leucocytes per c. m.....8,300	Lymphocytes:
		(a) Small 23
		(b) Large 2
		(c) Indentate Nucleus .. 2
		Neutrophiles:
		(a) Polymorphonuclear .73
1/24/'16.	Leucocytes per c. m.....8,600	Lymphocytes:
		(a) Small 20
		(b) Large 6
		Neutrophiles:
		(a) Polymorphonuclears 70
		Eosinophiles:
		(a) Polymorphonuclears 2
		Widal Negative.
1/25/'16.	Leucocytes per c. m.....7,000	Lymphocytes:
		(a) Small 24
		(b) Large 3
		(c) Indentate Nucleus .. 1
		Neutrophiles:
		(a) Polymorphonuclears 71
		Eosinophiles:
		(a) Polymorphonuclear . 1

	Quantitative.	*Differential Count.*
1/27/'16.	Leucocytes per c. m.....7,200	Lymphocytes: (a) Small .....27 (b) Large ..... 6 Neutrophiles: Polymorphonuclears 65 Eosinophiles: Polymorphonuclears 2
1/31/'16.	Leucocytes per c. m.....8,000	Lymphocytes: (a) Small .....25 (b) Large ..... 7 Neutrophiles: Polymorphonuclears 67 Basophiles 1
2/17/'16.	Erythrocytes per c. m. 3,800,000 Leucocytes per c. m.. 6,400 Hemoglobin (Sahli method) 63	Sahli Lymphocytes: (a) Small .....26 (b) Large ..... 2 (c) Indentate Nucleus .. 2 Neutrophiles: Polymorphonuclears 68 Eosinophiles: Polymorphonuclears 2
2/24/'16.	Erythrocytes per c. m 4,290,000 Leucocytes per c. m... 9,000 Hemoglobin (Sahli method) 68	Sahli Lymphocytes: (a) Small .....24 (b) Large ..... 4 (c) Indentate Nucleus .. 1 Neutrophiles: Polymorphonuclears 70 Basophiles 1
3/ 1/'16.	Leucocytes per c. m.. 9,000	
3/ 2/'16.	Erythrocytes per c. m 3,880,000 Leucocytes per c. m.. 10,200 Hemoglobin (Sahli method) 64	Sahli Lymphocytes: (a) Small .....20 Neutrophiles: Polymorphonuclears 80
3/ 5/'16.	Leucocytes per c. m.....10,400	Lymphocytes: (a) Small .....16 (b) Large ..... 3 (c) Indentate Nucleus .. 2 Neutrophiles: Polymorphonuclears 78 Eosinophiles: Polymorphonuclears 1
3/11/'16.	Erythrocytes per c. m. 4,080,000 Leucocytes per c. m.. 6,700 Hemoglobin (Sahli method) 66	Sahli
3/22/'16.	Leucocytes per c. m.....9,200	

Spinal fluid examination 3/6/'16.
Nonne strongly positive.
Lange 0. 0. 1. 2+. 2+. 1. 0. 0. 0. 0.
Cell count per c. m. 95.
Culture, none found.
Sugar 0.
Spinal fluid examination 3/8/'16.
Nonne strongly positive.
Ross-Jones strongly positive.
Lange 1. 1+. 1+. 3. 3+. 3. 3. 0. 0. 0.
Cell count per c. m. 973. Polymorphonuclears 95%.
Cultures negative.
Sugar negative.

We have here, therefore, a serous labyrinthitis resulting in a serous meningitis, occurring in an acute otitis media 27 days after the mastoid operation, and 52 days after the onset of the ear trouble.

What of the presumptive evidence that involvement of the labyrinth occurred by way of the ductus endolymphaticus? The labyrinth is involved scarcely ever through the semicircular canals in acute otitis media. The exceptions are cases of acute mastoiditis occurring in the course of severe scarlet fever, and in cases where there is a dehiscence of the external semicircular canal. As we had the opportunity to inspect the external semicircular canal, we may at least exclude this canal from macroscopic changes. This may be said also regarding the posterior and superior canals, which may also be excluded as gateways of infection, as there was healthy bone lying between them and the softened fistula which led to the posterior surface of the temporal bone. It is hardly possible that it could have occurred by way of the footplate of the stapes, or the fenestra rotunda, as the ear was drained thoroughly both by paracentesis through the tympanic membrane and posteriorly into the mastoid wound. The same may be said of the promontory.

If there had been a dehiscence of the external semicircular canal, which is very rare in adult life, or a dehiscence in the promontory, which is still more rare, the symptoms of involvement of the labyrinth would have occurred much earlier in the course of the disease.

The softened bone which I mentioned as having been present at the time of operation in the right ear, which was later involved in the labyrinthine trouble, extended directly to the meninges, which were very close to the situation of the aqueductus vestibuli. This I ascertained by boring several healthy bones in the direction taken by the fistula, finding that they very closely approximated the neighborhood of the saccus endolymphaticus.

In conclusion, I would emphasize a few points:

(1) That the saccus endolymphaticus may be involved more frequently than is usually supposed in acute softening processes of the mastoid.

(2) That it is our duty in all cases of mastoid involvement without external manifestations, except temperature, to very thoroughly search for softened areas deep down in the bone, and not cease until we come to healthy structure.

(3) That we should always bear in mind in suppurative labyrinthitis not only to open into the bony labyrinth, but to explore the region in which the saccus endolymphaticus is situated.

(4) That within the first few days serous labyrinthitis cannot be differentiated from suppurative labyrinthitis by any diagnostic means at present at hand.

(5) That absence of globulin, presence of lactic acid, absence of sugar, may be noted in inoffensive serous meningitis.

(6) That in these three cases viable microorganisms were not recovered from the cerebrospinal fluid, which, in my opinion, is the only differentiating point between spreading suppurative meningitis and serous, or circumscribed meningitis.

(7) Several lumbar punctures were made in the course of a week after the onset of meningeal symptoms, that is: whenever the headache, neck-stiffness and temperature increased. These punctures were invariably followed by improvement as evidenced by decrease in headache, stiffness of neck and temperature.

Discussion.

Dr. E. B. Dench, New York City, had reported, at the International Congress in London, in 1913, a case that simulated very closely those detailed by Dr. Pierce, except that in his own case there was lateral sinus thrombosis.

Dr. Christian R. Holmes, Cincinnati, Ohio, had not had a case like those reported by Dr. Pierce, but was glad to have his attention directed to this possible avenue of infection. Dr. Pierce's cases, in conjunction with those cited by Dr. Dench, should serve as a nucleus for further observations in this direction.

REPORT OF A CASE OF ACUTE MASTOIDITIS, WITH INFLUENZAL MENINGITIS. TREATMENT BY OPERATION ON THE MASTOID AND INTRASPINAL INJECTIONS OF ANTI-INFLUENZAL SERUM. FOLLOWED BY BRAIN ABSCESS—OPERATION—RECOVERY.

By FRANCIS R. PACKARD, M. D., Philadelphia, Pa.

E. C., eleven years old, was taken ill on Wednesday, October 2, 1913, on which day she came home from school after having been exposed to a severe wetting in a rain storm. That night she had a chill, followed by fever. A few days later she developed a pain in her right ear, which was followed by vomiting and headache. I was called in to see her, in consultation, by Dr. Knipe, the family physician, on the 12th of October, ten days after her initial chill. She complained of severe headache. Her temperature was 102°, pulse 120, and she seemed very irritable and had some photophobia. I incised her right ear drum and got a great quantity of pus from the middle ear. The next day, October 13th, she was admitted to the Pennsylvania Hospital and I opened her right mastoid. Before the operation she was seen by Dr. Arthur Newlin who agreed with me that she was suffering from meningitis with acute mastoiditis. The child lay in bed, on the left side, with head retracted, crying out sharply from time to time. The pupils were rather large, reacted to light and were equal, no nystagmus. Her heart and lungs were negative. Kernig's sign was present to a slight degree. Her blood count showed 26,000 leukocytes, 90% of which were polymorphonuclear. Upon opening the right mastoid, which I did under ether, the process was found to be extremely cellular, and the bone very soft in consistence, a small amount of pus in the antrum and in the cells towards the tip. Whilst she was under ether, a lumbar puncture was made in the fourth interspace by Dr. Billings and 20 c. c. of spinal fluid, under great pressure, were removed. The patient

reacted quietly after the operation. Owing to the appearance of the spinal fluid and the history of the case, it was decided to give the patient the anti-influenzal serum of Dr. Flexner, of the Rockefeller Institute, of which Dr. Richardson had some in the Ayer Clinical Laboratory. This was done the same evening and 30 c. c. of the spinal fluid were withdrawn and 30 c. c. of the anti-influenzal serum were injected, under ethyl chlorid anesthesia.

On October 14th, the following report was received from Dr. Richardson of the Ayer Clinical Laboratory of the Pennsylvania Hospital.

"The spinal fluid presented the typical picture of that from a case of acute meningitis, being very turbid. Noguchi's butyric acid test was positive and Fehling's copper solution was not reduced. Microscopic examination showed many pus cells, almost all of which were polynuclears. There were present some organisms which resembled B. influenzae. Some of the sediment was cultured on human blood agar. After twenty-four hours there appeared several fine white colonies made up of a small grammnegative bacillus. These on further study proved to be B. influenzae."

The same day, October 14th, another lumbar puncture was made by Dr. Billings, under ethyl chlorid anesthesia, and 30 c. c. of spinal fluid were withdrawn and 30 c. c. of the anti-influenzal serum injected.

On October 15 the patient was very much more comfortable, still had some photophobia, and Kernig's sign was marked in the right leg, with much less rigidity of the neck, and the child was brighter. She was again given ethyl chlorid and about 30 c. c. of spinal fluid were withdrawn by lumbar puncture from the spinal cord, followed by the injection of 30 c. c. of the anti-influenzal serum. On the 16th the child's condition was much the same, except that she was much more irritable. The lumbar puncture and the injection of the anti-influenzal serum was repeated, but very little fluid was withdrawn from the spinal column, and it was practically clear. Thirty c. c. of the anti-influenzal serum were injected.

On October 17th, the child's condition showed most distinct improvement. She was cheerful and bright, with no rigidity of the neck and Kernig's sign had practically disappeared. There was still some twitching of the muscles in certain parts of the body during sleep. This was the date of the last injection that the child received. Dr. Richardson furnished me with the accompanying laboratory note as to his findings throughout the period in which the child received injections of the anti-influenzal serum.

"The further examination of the fluid during treatment with the serum showed a gradually improving condition. There were no organisms found after the first specimen. The pus cells decreased in number and the butyric acid and Fehling's tests later became negative. Several specimens of spinal fluid were examined. The last showed almost normal fluid with only slightly increased number of white cells. The butyric acid test showed only the smallest possible flocculent precipitate, while Fehling's solution was reduced."

Up to this date the pus from the ear discharge showed a pure culture of staphylococcus aureus.

From this date, October 17th, which was four days subsequent to the operation and to the first injection of the anti-influenzal serum, the child's case followed a practically uneventful course, until October the 29th, 1913. Her mastoid wound had practically healed, there being only a small surface on the lower portion which had not healed over. There was a slight amount of serous discharge from the external auditory canal.

On Oct. 29th, the child developed a slight temperature, 100° accompanied by some rapidity of the pulse. She complained of headache and seemed very irritable. She had no Kernig's sign and no rigidity of the neck. Two days later, November 1st, she had several vomiting spells of a projectile character, and also seemed somewhat drowsy. Dr. William T. Shoemaker examined the eye grounds and reported that the right optic disk was very hazy. Dr. Robert G. Le Conte saw the child in consultation with Dr. Arthur Newlin and

myself. It was decided that the symptoms were indicative of brain abscess and on November 3, 1913, Dr. Le Conte and I opened the cranium. On exposing the dura it was found to be very tense and bulging and a large abscess cavity was found in the substance of the temporosphenoidal lobe. In the course of the operation the lateral sinus was accidentally punctured, but the hemorrhage was controlled without trouble. A rubber drainage tube was inserted into the wound which was packed with plain gauze.

The subsequent course of the case affords nothing of any particular interest. Drainage of the wound was done away with on November 11th, eight days subsequent to the operation, and the patient was discharged, cured, from the Hospital on December 7, 1913.

Dr. Richardson's report on the pus from the brain abscess showed a pure culture of streptococcus.

I have reported this case because it seems to me that the primary meningitis was undoubtedly influenzal and that the serum proved efficacious in its relief. The results following its administration were so striking that they seemed to be conclusive. I think it is also interesting to note that the laboratory report showed that the pus from the ear discharge and mastoid was a pure culture of staphylococcus; the culture from the spinal cord showed the influenzal bacillus; and the pus from the brain abscess showed a pure culture of streptococcus.

Discussion.

Dr. E. B. Dench, New York City, did not like to get a report of staphylococcus infection from the middle ear and when such a report come in, as was sometimes the case in one hospital with which he was connected, he generally sent it back. Culture would usually reveal streptococci. In one case the bacteriologist said there were only a few isolated organisms and a few short chains in pairs. He requested a culture. A few hours later long-chain streptococci were reported. He thought staphylococcus infection of the mastoid and of brain abscess extremely rare, the staphylococcus

generally representing an overgrowth, the true organisms not being discovered.

Dr. Ewing W. Day, Pittsburg, Pa., thought the confusion of streptococcus and staphylococcus infection was a matter of faulty technic. He believed, however, that it was not impossible to have a staphylococcus infection going on in the meninges, and when it did occur it was just as severe as streptococcus or any other infection.

Dr. Norval H. Pierce, Chicago, Ill., agreed that fatal meningitis might result from a pure staphylococcus infection. He recalled one case in which the patient died from sepsis following sinus thrombosis, in which the staphylococcus was isolated from the mastoid wound, from the sinus when it was opened, and from the blood a little later. There was absolutely no doubt about death being caused by staphylococcus pyemia. He had had very few such cases. He considered a pure staphylococcus infection may be very dangerous.

Dr. Packard in closing the discussion, stated that the bacteriological findings had been gone over in Dr. Flexner's laboratory, as was the rule when the serum was first furnished from it. The primary bacteriological findings were confirmed in this manner. He had every reason to believe that the bacteriologist was right in all the findings as he was a most experienced and careful man.

MALARIA SIMULATING DISEASES OF THE MASTOID AND FRONTAL SINUS.

By CHARLES W. RICHARDSON, M. D., Washington, D. C.

Malaria, like syphilis, affects many organs and tissues of the body, producing lesions thereby, and through action upon the nervous system may simulate diseases of other organs and tissues which are not directly affected by the parasites of these diseases.

I wish to present to you today two interesting cases wherein the malarial parasite, through its invasion of the organism, produced striking subject evidences in one case of mastoiditis and in the other of frontal sinusitis. These cases present beyond these interesting facts nothing of unusual interest. The diagnosis was readily made through exclusions without any difficulty, and were confirmed by the blood examinations.

The first case, that simulating mastoiditis, was brought to my attention by my assistant, Dr. W. H. Huntington, immediately after I had finished a rather laborious afternoon in the operating room. The provisional diagnosis was mastoiditis, with probably intracranial complications. Due to lack of time, I made only a cursory examination and quickly reviewed the history, found the evidence such as to warrant a strong doubt in my mind both as to the mastoid infection, as well as the more serious phase of the case. I ordered a blood examination and count and urinalysis. Dr. Huntington had already made an examination of the eyegrounds. In the late afternoon, I made a most thorough examination of the patient, and through the history, and the results of this examination I became convinced that the mastoid symptoms were due to other causes than suppuration. At this time I had also the benefit of both the blood examination and the urinalysis.

The history of the case as prepared by Dr. Huntington is as follows:

Miss M. L. H., female, white, 21 years of age, was admitted to the Episcopal Eye, Ear and Throat Hospital, December 8, 1915. Family history negative. Previous history: Had measles when eight years of age. Had chills during infancy. No previous affection of the ears. Present illness, marked evidence of great prostration, requiring support in walking. Very pale. Had acute suppurative otitis August 15, 1915 with spontaneous rupture of membrana tympani. Discharge continued until November 6, 1915, when it ceased. At this time postauricular pain became manifest and gradually grew worse, with swelling back of ear and in neck. About a week later headaches, which were not constant and confined to occipital region. Vomited at times. About second week in November had chills, which were unattended with sweats. Complained of great thirst and drank abundance of water. Urine at that time was scanty and very dark. During past few days has had marked pain over mastoid region. For past two weeks has noticed gradual diminution of vision. Physical examination: Left ear normal. Right ear shows a central kidney shaped perforation. Ear dry. Pressure over mastoid, as well as, along course of jugular vein causes pain. No edema. Pulse 120. Temperature 101°. Eye, slight exophthalmos. Pupils widely dilated, but reacted to light and accommodation. No nystagmus. Vision impaired. Figures at ten feet. Eye-ground shows bi-lateral papillitis with hemorrhage and exudate around vessels. Arteries small. Veins congested and tortuous. No exudate at macular region.

When I first saw this patient I was impressed with her hysterical facial expression and marked pallor. Examination of ears demonstrated them to be as given in the history. The tenderness over the right mastoid was very great, as well as along the course of the jugular vein. When the patient was placed upon her feet and told to walk, she would advance a few steps and then begin to totter, showing rather an evidence of weakness than of any central lesion. The double optic papillitis also excited my suspicion, as there were no

evidences of any acute cerebral lesion that could account for its centric origin. The head-pain, the pallor and the slight mental hebetude inclined me to await an examination of the urine and blood before making a diagnosis. The urinalysis made from urine drawn by catheter was as follows: Color, dark brown, very turbid. Specific gravity 1023. Reaction, acid. Sugar, considerable quantity. Albumen, trace. Microscopic: Casts, granular, hyaline and epithelial, with a predominence of granular. Many disintegrated blood cells. Blood examination: Malarial parasites present. Leucocytes, 8,800.

The patient was given quinine in large doses. Large draughts of water, the Murphy drip and hot packs. Under this treatment the temperature gradually subsided from 101.2° on entrance to 99°. On December 11, there was a rise in temperature to 102°, unattended with chill, which subsided to normal December 12th. From December 12th until the patient was discharged the temperature was flat. Blood examination made after December 12th demonstrated a freedom from malaria. The urinalysis showed normal urine after December 16th. The mastoid tenderness and the general condition of the patient improved from day to day. The papillitis improved considerably and the vision became clearer, but neither had returned to the normal when the patient was discharged from my service, January 4, 1916. Some weeks later the patient returned to the hospital on account of the want of further improvement of the eye condition.

On account of a brother of the patient, an attendant in the dispensary service having been found to be a syphilitic, a Wassermann was made upon the patient with a positive finding.

Case II. The case of frontal sinusitis presents a more clearly defined history of malarial origin than the case of mastoiditis, as it was uncomplicated. The patient was a young locomotive fireman, who lived in a malarial district in the State of Maryland. When I first examined him he manifested all the subjective evidences of a frontal sinus

infection. He complained of intense frontal head-pain. There was a marked tenderness over the left frontal region, which was particularly marked in the floor of the sinus. Inspection of the nose demonstrated an absolutely normal nasal chamber. Postnasal examination also showed no deviation from the normal. The following day I again went carefully over the patient, and from the total absence of all objective evidences of frontal sinus infection, and from the fact that the patient had dwelt in a malarial district, I directed that a blood examination and count be made. The patient was admitted to the Episcopal Eye, Ear and Throat Hospital, December 28, 1915. The history is as follows:

J. W. S., 24 years of age, living at Pleasant Heights, Maryland. Mother living, well, age 47; father living, well, age 51. Maternal grandmother living, well, age 74. Paternal grandmother living, well, age 75. Diseases previous: Measles 2, chickenpox 4, whooping cough 10, malarial fever 8 years. Physical examination: Weight 160 lbs.; height 5 ft. 10½ in. Chest measurement 36 exp., 40 insp.; waist measurement 33; robust, well-formed. Heart, lungs, liver, joints, etc., normal. Tenderness and pain over left eye, increased on pressure. Personal habits: Lives in a swampy, poorly-drained district; is employed as a locomotive fireman. Uses tobacco moderately. Uses alcohol moderately, a glass of beer or whiskey each day, sometimes two; more if on party. Retires at 10 p. m., rises 5 a. m. Sleeps well at night in house not well screened.

In the summer time is in the habit of sitting on unscreened porch and is bothered a great deal by the mosquitoes. Has not been away from home in eight years. Is a big meat eater, twice a day averaging one and one-half pounds of meat per day. Present illness: About five weeks ago patient had a heavy cold on his chest, later extending into the nose and pharynx (naso). This sickness began with a severe rigor accompanied by pains in the head particularly at the frontal region. The patient also complained of a bitter taste in the mouth. Had a temperature for the first week, pains in the back and legs, malaise, no appetite, bowels regular, frequent

micturition. The pains in his head increased and Dr. Apgar sent him to the Episcopal Eye, Ear and Throat Hospital. Upon admission he was suffering from pain and tenderness over the left eye and the frontal region of the forehead. Pain was markedly increased upon pressure. No discharge from the nose other than normal. Pain was not increased by the reclining posture. Clinical examination: Urine showed nothing abnormal. Blood showed the presence of a large number of certain malarial parasites. Scarcely one erythocyte could be found free from the parasite. The leucocytes were at first decreased five thousand per cubic millimeter, later there was a leucocytosis, twelve thousand per cubic millimeter. Treatment: Quinine sulphate grains five every three hours were given for the first four days. The malarial parasites showing marked decrease in numbers. The fifth day they showed increasing numbers. The quinine was then increased to five grains every two hours. The parasites again decreased and almost entirely disappeared. The pain over the left eye and frontal region entirely cleared up and the patient was discharged as cured of the condition for which he came to this hospital. Diagnosis: Malaria involving the frontal sinus. Prognosis: Favorable.

It is interesting to note that although the patient was infected through a certain malarial parasite he had never had a chill, fever, or other evidences of malarial infection. During the two weeks that he was under our observation he ran a normal temperature. I never saw a field in a slide from a malarial patient that showed more parasites in it than did the slide which I examined of this blood. Under appropriate anti-malarial treatment the parasities disappeared from the blood. With the disappearance of the malarial infection the frontal sinus pains and tenderness also gradually passed away. The patient was discharged cured at the end of two weeks.

Discussion.

Dr. Christian R. Holmes, Cincinnati, Ohio, asked Dr. Richardson to what he attributed the choked disc. Twenty years ago he had reported a case of repeated intra-ocular hemorr-

hages for which he could find no explanation except that it was of malarial origin, the patient being a farmer from the Wabash region. The man finally moved to Pennsylvania and had no further trouble.

Dr. Huntington, Washington, D. C., had made a tentative diagnosis of mastoiditis and possible sinus thrombosis from the examination of the eye-grounds, history of abscessed ear, with other clinical symptoms. It was the most remarkable choked disc he had ever seen,—from two to four diopters. Two or three weeks after this a boy was admitted to the clinic with specific ulcer of the pharynx, but he had not associated the two patients as brother and sister. After the girl was discharged he followed her case, and when he got the report in the second case he learned of the relationship. Each patient was put under specific treatment with injections into the vein of the Canadian product and also salvarsan. The boy had a plus Wassermann and Noguchi, as did the girl. The lesion cleared up promptly, but the Wassermann remained plus. The girl had had five injections and was still positive. Dr. Huff, the neurologist, had made a spinal puncture, and an examination of the nervous system, thinking perhaps she had cerebral syphilis, and obtained a negative result, everything being normal. She was then put under iodid of potassium treatment. The choked disc cleared up, and vision was 20/20.

Dr. O. A. M. McKimmie, Washington, D. C., believed many cases occurred in which it was difficult to make the diagnosis because it was not always possible to find the organism. He recalled two such cases. In one case there was severe earache, pain in the mastoid region, temperature of 104 degrees, and the drum was red. There was no history of chills. He saw her first in the middle of the day, and declined to open the drum. When he saw her in the evening he decided to operate. He got no pus, but the symptoms subsided, the temperature dropped, and the pain in the ear and the mastoid region disappeared. The next day the symptoms

recurred. He put her on 20 to 30 grains of quinine a day, and she got well. In the second case, everything pointed to lateral sinus thrombosis, and this was found when Dr. Huntington operated. The temperature went up each day at noon to 104 degrees. Repeated blood examinations failed to reveal the organism, but the patient got well when put on quinine. These patients were apt to have leukopenia.

Dr. Norval H. Pierce, Chicago, Ill., cited a case in which the patient had been operated upon for acute mastoiditis. After perhaps three days he was seized with a chill, high elevation of temperature, which sank, accompanied by diaphoresis. Preparations were made for operation upon the sigmoid sinus. It was at this juncture that he was called to see the case. The patient did not look as ill as he should have looked from sepsis. There was no increase in the leococytes in the blood. The question of malaria arose, but the man denied having had it. Examination of the blood, however, revealed the plasmodidum, and the whole condition cleared up under the administration of quinine. So far as the temperature, chills, and sweats were concerned, it was a case of pyemia.

FURTHER OBSERVATIONS ON THE RELATION OF AUTOINTOXICATIONS TO ACUTE MEMBRANE DISTURBANCES.

By SARGENT F. SNOW, M. D., Syracuse, N. Y.

In 1908, I began a series of articles on the relation of autotoxic states of the system to inflammatory processes. Of this series, in which this is the seventh, two were read in 1909, one before this Society and one before the Sixteenth International Otological Congress at Budapest. In 1912, another came before this Society and during the years 1910, 1911, and 1915, papers before other medical societies, state or national, were read by the author, all calling attention to the intimate relation that appeared to exist between autointoxications and inflammatory activities, so that we may call this paper a "Further Observation" on the Relation of Autointoxications to Acute Membrane Disturbances.

In presenting such a paper, I will try to show as clearly and concisely as possible, the conclusions drawn from a twenty-five years' practice, devoted *exclusively* to the Ear, Nose and Throat, twelve years of which has included Active Dispensary and Hospital work, the whole twenty-five years having been quite largely employed in meeting and combating membrane disturbances. The views set forth need not be accepted as authorative, for they are largely personal views and may be at variance with some generally adopted, but they are presented with honesty of purpose and the hope that they may help clarify the situation as to the fundamental principles involved in handling, at least, common head colds and allied inflammations of the accessory sinus, ear, mastoid, pharynx and larynx.

Let us start with the premise that the human body is a fortress, equipped with munitions of war, and a fighting army; —that for the *ordinary* diseases it has a trained army of body cells, capable of withstanding the onslaughts of an outside

enemy if our body functions are working so good that we have *not* an inside enemy undermining our resistance.

For the extraordinary diseases, such as Small-Pox, Typhoid, Typhus, and other acute scourges of mankind, our system seems to require *inoculative* protection to *especially* train body cells against those particular kinds of infection, as was so ably pointed out by Prof. Vaughn at the last meeting of the New York State Society in Buffalo.—(N. Y. State Journal of Medicine for May, 1915.)

All our respiratory membranes and the membranes lining connecting cavities, are the common habitat of various inflammatory bacteria of outside origin, ready for propogation and development as soon as our army of defense becomes weakened or is called upon to subdue some inside enemy:—this inside enemy seems to be always with us in the form of intestinal bacteria believed by "Combe", an excellent authority on autointoxication, to be "provided by nature to complete digestive processes":—but these same digestive bacteria, under putrefactive influences, may become over-abundant and their toxins a menace unless kept under subjection by inhibiting liver and other bacteriolytic secretions from above.

I myself, freely accept the belief that we should maintain a proper balance between the inhibitory intestinal juices of the upper bowel and the bacteria of the lower bowel; while such a balance is kept, we, need have no fear of colds and other common membrane congestions. In other words the determining "Cause of Membrane Inflammations" seems to rest upon the question whether our protective army is in full array, or is it engaged in a battle with a putrefactive disturbance in the intestinal canal? If it is engaged in such a battle it leaves our nose, ear and pharynx membranes unprotected and a prey to pernicious microorganic tenants. Concisely stated, intestinal autointoxication seems to permit the development of inflammations elsewhere. An autotoxic state favors acute membrane disturbances; our patients are *then* vulnerable to outside infective influences.

By autointoxication is meant those self poisoned states that come from bacteria originating within our body, not autoinfections that come from bacteria originating outside our body.

Some autointoxications are active, resulting in so-called bilious attacks, etc., some are passive and more chronic, resulting in sensitive cachectic individuals, prone to various disorders.

Some autotoxic attacks are only attended by a slight malaise, other attacks are more pronounced, showing fever and a general systemic disturbance. The first mentioned kind is often periodic and is the actual basic cause of many of the chronic diseases of the body, while the more active and profound autotoxic states seem to furnish the ground work of destructive inflammations.

Sir Arbuthnot Lane, the famous English surgeon, is reported to claim that "most of the ills and diseases that the flesh is heir to are of autotoxic origin and that were it not for intestinal stasis and autointoxication there would be no *need* for physicians and surgeons."

In my 1910 article, I find the following: "If we are able to handle and prevent acute inflammation of the respiratory membranes known as common colds by recognizing and treating the patient's autointoxication, what may we not hope will sometime be done with the more grave affections. It appears to the author like the dawn of a new era, and he hardly dares let his fancy travel."

Today, in the year 1916, it would seem that scientific workers, supported by laboratory findings, were bringing my dreams true, and that my earlier articles did rightly predict the dawn of a "new era" in medicine.

The most prominent causes of an autotoxic state are lowered vital powers, overeating, constipation or at least inadequate bowel movements,—bowels perhaps correct so far as regularity and number of passages are concerned, but the stools are compact or hardened masses that represent what a distended, overloaded colon can no longer retain —a marked intestinal stasis being a habit rather than the

needed free unloading of soft feces two or three times a day. In autotoxic subjects the transition from a healthy state to one of acute inflammation is often but a short step. The toxins that arise from putrefactive changes in a constipated subject, permeates the whole system and saps his vital resistance.

It is not irrational to expect that incompetency of the ileocecal valve with regurgitations is a common cause of ileal stasis as suggested by Dr. J. H. Kellogg (Lancet-Clinic, May 29th, 1915).

Autointoxication is practically the determining cause or systemic condition that permits inflammations. I say permits, because nature seems to have given us immunity from most outside germs, if our functions are working properly.

Quoting from my last paper before this Society, published in the London Lancet of October 1911, I note this was said: "Autointoxication has a multiplicity of causes, each one leading up to a time when the system can no longer tolerate its load of poisonous substances. The different organs and membranes of the body are forced to do, and will do, double eliminative work until some organ fails or flags in its function; then we have an acute inflammation in some part of the body from the faulty metabolism—an autotoxic crisis."

Quarantine and sanitation are solving many problems that have to do with our outside enemies but the problems surrounding questions of diet, digestive function, eliminative organs, and how to keep our inside enemies under subjection is still open to much study and investigation, in fact they are the pregnant medical questions of the day and I hope will soon be taken up with more energy than is now displayed.

We are not sure yet whether food should even be cooked or baked? We certainly were not created to gorge ourselves with the conglomerate but attractive combinations often set before us. It is no wonder that our liver and digestive secretions fail in their task to keep the proper balance. Temper-

ance and caution in eating are quite as essential as temperance and caution in drinking. Over-indulgence is quite as disastrous in one as in the other, if we take into consideration the many afflictions that can be traced back to self-poisoning.

I would place special emphasis upon the need of local efforts, surgical and otherwise, towards keeping inflammations within bounds. We must not disregard the knife, nor delay its use to prevent absorption of pus products, but, we are all justified in attempting to avoid operations when the case is seen *reasonably* early. It can hurt none of us to give a little more consideration to the fundamental causes of inflammatory actions and be a little less led by the glamour of brilliant operating.

When the patient is "ripe with pus," because of bacterial virulence or delay in seeking medical advice, we have no alternative but to secure free and adequate drainage at once, but if they are seen early, before pus formation, we can, very properly and safely, expect good effects from our "emergency agent," calomel, given freely and fearlessly under 20th century methods.

The scope of this paper does not permit me to go very deeply into the question of treatment,—my personal method in all acute membrane inflammations is to start with calomel, 2 to 4 grains in quarter grain doses according to the case, repeating it next day if marked activity persists. In mastoid troubles I frequently start with an enema, in fact I cannot speak too earnestly, nor urge too strongly a prompt, efficient clearing of the bowels in all acute inflammations, even if only salts or castor oil are chosen.

The prejudice against calomel has deterred and is even now preventing its use in many cases of acute membrane disturbances where its proper employment, as a stimulant to antitoxic secretions, would give much relief and be likely to save the patient from the knife,—my records are so replete with instances where startling and impressive results have followed the adequate use of this form of mercury, even in streptococcic infections, before or after

operating, that I would urge all to throw aside their fear or prejudice and give it a trial in these dangerous cases, both as an emergency cathartic and an antitoxic stimulant.

As early as the year 1909, in the paper of this series, presented at the International Otological Congress held in Budapest, the following observations were made,—"calomel, we know, not only eliminates autoinfective material, but it disinfects the lower bowel. It also stimulates functional activity of the liver and of the glandular structures of the body, so that their secretions act as effective antitoxins against bacterial invasion and consequent active membrane congestions."

The idea that mercury stimulated the production of body antitoxins was the only way I could then explain clinical results, and this has actually been my belief since 1905,—now, seven years later, my attention has been called to the fact that Prof. Sajous in his seventh edition on "Internal Secretions," just issued, Volume II, pages 1147 to 1185, makes the same claim as to the ability of mercury to stimulate body antitoxins, calling them autoantitoxins, explaining how they are produced, as follows: "The various salts of mercury owe their therapeutic value to the energy with which they stimulate the test organ," which he concludes is the anterior pituitary body. "Only small doses, 1/10 grain, of calomel are needed to excite the test organ and make the blood autoantitoxic, but if flushing of the intestine is desired and a copious flow of antitoxic intestinal juice in addition to the hepatic action, larger doses, ⅙ to ½ grain, every 15 or 30 minutes until one or two grains are taken, may be ordered."

He further says: "The bacteriolytic and antitoxic activity which the blood and the intestinal juices acquire under the influence of mercurials accounts for the beneficial effects observed in various infectious diseases."

In cases of active infection, minute doses given at 2 to 4 hour intervals seem a rational treatment though, as stated earlier in this paper, I start then with quarter grain doses, at short intervals, until 2 to 4 grains have been given, fol-

lowing this with a saline so as to be ready to repeat the strenuous treatment next day if necessary.

Personally I do not like to advise calomel or any cathartic, except in emergencies, but I consider the danger from its intelligent use slight as compared to the benefits derived.

With reliable and useful agents to stimulate the production of "Auto-antitoxins" for the prevention and cure of disease, how much greater will be our leverage, how much better armed we will be, how much the practice of medicine will be simplified, if men engaged in general and surgical work find also, as I have from time to time tried to show, that an autotoxic state is a determining factor in most of the inflammations of the body, both acute and chronic.

All the cases of laryngeal tuberculosis, coming under my observation, have had what I now know were marked autotoxic disturbances with each exacerbation, and these exacerbations have seemed to be the result, more than the cause of their autointoxications. Sajous even contends that the development of cancer is due to hypoactivity of the body's protective mechanism.

To sum all up, I will first ask for your indulgence,—as this paper is probably far from being the "last word" on the subject, but, in all candor I must say that since my practice has been conducted along the lines indicated, noting carefully by the skin, eyes, tongue and breath *each* evidence of self poisoning, vigorously combating this autotoxic factor and waking up the patient's vital resistance, I find my work much more simple, clear cut and satisfactory. Inflammations commonly melt away like snow under a summer sun and the need of the knife becomes less and less frequent.

"Further observations," making 15 years that I have worked along these lines, gives me courage to state that I honestly, and earnestly believe that when conditions are better studied, the medical profession will accept the fact that autointoxication is responsible for most of our human suffering, and that we have agents so efficient in controlling inflammations, by stimulating antitoxic secretions, that 75%

of the emergency operations we are now doing will be found avoidable, old age will be deferred and the practice of medicine will have to be largely rewritten.

Discussion.

Dr. Christian R. Holmes, Cincinnati, Ohio, did not agree with Dr. Snow with regard to the 75 per cent. of avoidable emergency operations, but he did agree that it is very important to look after the elimination and the prevention of autointoxication. He believed that physicians, generally, were following this line, more, perhaps, than Dr. Snow seemed to think. For about eight years he had been devoting a great deal of attention to this subject, and had made it a practice to get his cases of catarrhal deafness, nasal catarrh, etc., into the hospital, where he could control their diet and habits of life, and where he could thoroughly clear them out with calomel or saline, electric and steam baths, pilocarpin, etc., in connection with the local treatment. He tried to impress upon these patients the importance of carrying out the plan of living outlined to them. He was glad to see that Dr. Snow was persisting in his work along these lines.

Dr. Snow, in closing the discussion, said perhaps his enthusiasm had caused him to place his estimate too high, as Dr. Holmes had suggested. He formerly ordered cathartics as a routine, but his results had improved since the adoption of his present plan of following up the cases by repeating the mercurial until the tongue becomes pink and moist. In many instances he had found that when he gave the second dose of calomel he had only begun the cleaning out process. Sometimes it would take five days of strenuous work to effect the desired cleaning.

TRANSACTIONS

OF THE

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FIFTIETH ANNUAL MEETING.

HOTEL CHELSEA,

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Dr. Harry Friedenwald....1029 Madison Ave.....Baltimore, Md.....

Dr. Blancome E. Fryer.

Dr. Max A. Goldstein.....3858 Westminster Place...St. Louis, Mo.....

Dr. John Green.

Dr. Emil Gruening.

Dr. George W. Hale.....Wilcox Building.....Nashville, Tenn.....
Dr. Thomas H. Halsted.....831 University Block.....Syracuse, N. Y.....
Dr. Philip Hammond.....483 Beacon St.....Boston, Mass.....
Dr. Herbert Harlan.....516 Cathedral St.....Baltimore, Md.....
Dr. Thomas J. Harris.....104 East 40th St.....New York, N. Y.....
Dr. David Harrower.....9 Elm St.....Worcester, Mass.....

Dr. N. Darrell Harvey... ..114 Watermann St.....Providence, R. I.....
Dr. William H. Haskin.....West Point, N. Y....
Dr. R. Johnson Held*.....616 Madison Ave.....New York, N. Y.....
Dr. Neil J. Hepburn.....317 West 23rd St.....New York, N. Y.....

Dr. James Hewitt.

Dr. Christian R. Holmes....8 East 8th St.....Cincinnati, Ohio.....
Dr. Edgar M. Holmes*.....531 Beacon St.....Boston, Mass.....
Dr. Erastus E. Holt.....723 Congress St.....Portland, Me.....
Dr. Frank T. Hopkins*....616 Madison Ave.....New York City... ...
Dr. Thomas Hubbard.....515 Nicholas Bldg.....Toledo, O.....
Dr. J. M. Ingersoll*.....1021 Prospect Ave.....Cleveland, Ohio.....
Dr. Frederick L. Jack.....215 Beacon St.....Boston, Mass.....
Dr. Walter B. Johnson.....170 Broadway.....Paterson, N. J.....
Dr. Isaac H. Jones*..... 1831 Chestnut St.....Philadelphia, Pa.....
Dr. Richard Jordan.....165 West 58th St.....New York, N. Y.....
Dr. Joseph A. Kenefick.....103 East 55th St.....New York, N. Y.....
Dr. B. R. Kennon.....201 Taylor Bldg.....Norfolk, Va.....
Dr. Philip D. Kerrison.....58 West 56th St.....New York, N. Y.....

Dr. Gordon King.

Dr. Charles J. Kipp.

Dr. Albert F. Koetter*.....303 Humboldt Bldg.....St. Louis, Mo.....

Dr. D. Braden Kyle.

Dr. J. W. Lawton.

Dr. George A. Leland.....354 Commonwealth Ave....Boston, Mass.....
Dr. John C. Lester.....432 Madison Ave.....New York, N. Y.....
Dr. Eugene R. Lewis*.....1130 Main St.....Dubuque, Iowa .....
Dr. Robert Lewis .....48 West 40th St.....New York, N. Y.....

Dr. W. S. Little.

Dr. Hanau W. Loeb.....537 N. Grand Ave.....St. Louis, Mo.....
Dr. James E. Logan.....1208 Wyandotte St.....Kansas City, Mo.....
Dr. Francis B. Loring.....1420 K St., N. W.....Washington, D. C.....
Dr. David B. Lovell.....Rooms 407-408 State Mutual Building .....Worcester, Mass.....

Dr. C. J. Lundy.

Dr. Stephen H. Lutz..... 284 Hancock St.....Brooklyn, N. Y... .

Dr. G. Hudson-Makuen.

Dr. George B. McAuliffe....616 Madison Ave.....New York, N. Y.....
Dr. James F. McCaw.....Bank & Loan Bldg.....Watertown, N. Y.....
Dr. Read J. McKay.....9th & Market Sts.....Wilmington, Del.....
Dr. James F. McKernon....62 West 52nd St.....New York, N. Y.....
Dr. O. A. M. McKimmie....1330 Mass. Ave. N. W.....Washington, D. C....
Dr. Cyrus S. Merrill.....27 South Hawk St.....Albany, N. Y.....

Dr. Horace J. Miller.

Dr. W. W. Moreland.

Dr. Henry L. Morse.....112 Marlborough St.....Boston, Mass.....
Dr. Harris P. Mosher.....828 Beacon St.....Boston, Mass.....
Dr. Willis B. Moulton*.....180 State St.....Portland, Me.....
Dr. Robert C. Myles.....11 East 48th St.....New York, N. Y.....

Dr. James E. H. Nichols.

Dr. Henry D. Noyes.

Dr. J. F. Noyes.

Dr. Francis R. Packard....304 South 19th St.....Philadelphia, Pa....
Dr. John R. Page*.....127 East 62d St.....New York, N. Y.....
Dr. Charles E. Perkins.....125 West 82nd St.....New York, N. Y.....
Dr. Wendell C. Phillips.....40 West 47th St.....New York, N. Y.....
Dr. Norval H. Pierce.....22 E. Washington St.....Chicago, Ill.....
Dr. Edward M. Plummer....5 Adams St.....Charlestown, Mass....

Dr. Oren D. Pomeroy.

Dr. Barton H. Potts.

Dr. George H. Powers, Jr.*.298 Marlborough St.....Boston, Mass.....
Dr. John B. Rae.....247 West 70th St.....New York, N. Y.....
Dr. B. Alexander Randall...1717 Locust St.....Philadelphia, Pa.....

Dr. Wm. Rankin, Jr.

Dr. J. M. Ray.....Atherton Building.....Louisville, Ky.....
Dr. Henry O. Reik.....506 Cathedral St.....Baltimore, Md.....
Dr. W. Scott Renner.....341 Linwood Ave.....Buffalo, N. Y.....
Dr. George L. Richards.....124 Franklin St.....Fall River Mass.....
Dr. Huntington Richards.....Concord, N. H.....
Dr. John D. Richards*.....8 East 54th St.....New York, N. Y.....
Dr. Charles W. Richardson..1317 Connecticut Ave.....Washington, D. C.....
Dr. Stephen O. Richey.....732 17th St.....Washington, D. C.....

Dr. Charles E. Rider.

Dr. F. W. Ring.

Dr. Henry W. Ring.....185 Church St.....New Haven, Conn....
Dr. Arthur W. de Roaldes...1328 Jackson Ave.....New Orleans, La.....
Dr. Walter Roberts.....1732 Spruce St.....Philadelphia, Pa.....
Dr. William K. Rogers....188 East State St..... Columbus, Ohio.....

Dr. D. B. St. John Roosa.

Dr. John D. Rushmore.....129 Montague St.....Brooklyn, N. Y.....
Dr. W. E. Sauer*.....201 Humboldt Bldg.....St. Louis, Mo.....
Dr. T. Laurance Saunders*.45 West 50th St.....New York City.....

Dr. Wm. W. Seely.

Dr. Ralph W. Seiss.....255 South 17th St.....Philadelphia, Pa.....

Dr. S. Sexton.

Dr. George E. Shambaugh..People's Gas Bldg.....Chicago, Ill.....
Dr. John B. Shapleigh.....Grand & Washington Aves..St. Louis, Mo.....

Dr. Warren S. Shattuck....160 Clinton St.....Brooklyn, N. Y.....

Dr. Henry L. Shaw.

Dr. Burt R. Shurly*.....32 Adams Ave. W.....Detroit, Mich.....
Dr. E. Terry Smith.....36 Pearl St.....Hartford, Conn.....
Dr. S. MacCuen Smith.....1429 Spruce St.....Philadelphia, Pa.....
Dr. Sargent F. Snow.....707 University Block.....Syracuse, N. Y.....

Dr. Edmund D. Spear.

Dr. Selden Spencer.....2725 Washington Ave.....St. Louis, Mo.....

Dr. Frank Sprague.

Dr. Franklin M. Stephens...19 West 54th St.....New York, N. Y.....
Dr. George T. Stevens.....350 West 88th St.....New York, N. Y.....

Dr. Samuel B. St. John.

Dr. George Strawbridge.

Dr. Joseph A. Stucky.....Lexington, Ky.....
Dr. Edward Blair Sutphen*.162 South St.....Morristown, N. J.....
Dr. Theron Y. Sutphen....999 Broad St.....Newark, N. J.....
Dr. Lewis H. Taylor.....82 South Franklin St.....Wilkes Barre, Pa.....
Dr. J. J. Thomson.....3 Park Ave.....Mt. Vernon, N. Y.....

Dr. William Thomson.

Dr. Robert Tilley.

Dr. Andrew Timberman*...112 East Broad St.....Columbus, Ohio.....
Dr. George L. Tobey*.....416 Marlborough St.....Boston, Mass.....

Dr. J. J. B. Vermyne.

Dr. Ernest de Wolfe Wales..605 Hume-Mansur Bldg....Indianapolis, Ind.....
Dr. D. Harold Walker.....390 Commonwealth Ave....Boston, Mass.....
Dr. David Webster.....24 East 48th St.....New York, N. Y.....
Dr. Joseph A. White.....200 East Franklin St.....Richmond, Va.....
Dr. Edward Wheelock.....26 Gibbs St.....Rochester, N. Y.....
Dr. Fred Whiting.....19 West 47th St.....New York, N. Y.....
Dr. Frederick M. Wilson...834 Myrtle Ave.....Bridgeport, Conn...
Dr. John Gordon Wilson....104 S. Michigan Ave.....Chicago, Ill.....
Dr. Hiram Woods.....842 Park Ave.....Baltimore, Md.....

*Associate.

American Otological Society.

The fiftieth annual meeting was held at the Hotel Chelsea, Atlantic City, May 29th and 30th, 1917.

The following members and guests registered during the meeting:

Dr. D. HAROLD WALKER
Dr. EDWARD M. PLUMMER
Dr. BURT R. SHURLY
Dr. B. ALEXANDER RANDALL
Dr. WARREN S. SHATTUCK
Dr. T. H. HALSTED
Dr. E. M. HOLMES
Dr. GEO. L. RICHARDS
Dr. HANAU W. LOEB
Dr. GEORGE E. SHAMBAUGH
Dr. O. A. M. McKIMMIE
Dr. HENRY O. REIK
Dr. CHARLES N. COX
Dr. JOHN F. BARNHILL
Dr. CHRISTIAN R. HOLMES
Dr. GEORGE B. McAULIFFE
Dr. JOHN J. THOMSON
Dr. J. WHITE RICHMOND
Dr. T. C. LYSTER, Maj. Med. Corps, U. S. A.
Dr. J. F. McCAW
Dr. E. B. DENCH
Dr. ROBERT LEWIS
Dr. E. BLAIR SUTPHEN
Dr. F. J. BLODGETT
Dr. FRANK T. HOPKINS
Dr. T. L. SAUNDERS
Dr. JAMES E. LOGAN
Dr. L. W. DEAN
Dr. J. M. INGERSOLL
Dr. R. BUTLER
Dr. JAMES F. McKERNON
Dr. J. A. STUCKY
Dr. THOMAS
Dr. H. W. LYMAN
Dr. HENRY HORN
Dr. FRANCIS P. EMERSON
Dr. G. P. MARQUIS
Dr. S. MacCUEN SMITH
Dr. ARTHUR B. DUEL
Dr. SARGENT F. SNOW
Dr. JOSEPH C. BECK
Dr. STEPHEN H. LUTZ
Dr. NORVAL H. PIERCE
Dr. CHRISTIAN R. HOLMES
Dr. JOHN B. RAE
Dr. DAVID WEBSTER
Dr. CHARLES W. RICHARDSON
Dr. ROBERT C. MYLES
Dr. JOSEPH H. BRYAN
Dr. E. E. HOLT
Dr. EWING W. DAY
Dr. EUGENE R. LEWIS

MINUTES.

Executive Session.

May 29, 10 A. M.

Call to Order.

President's Address.

Introduction, by the President, of Dr. David Webster, of New York, oldest living member of the Society.

Reading of the Minutes of the Forty-ninth Annual Meeting. Moved and seconded that the Minutes be approved as read. Carried.

Appointment, by the President, of the Business Committee, as follows:

Dr. Robert Lewis, New York, Chairman,
Dr. S. MacCuen Smith, Philadelphia,
Dr. Arthur B. Duel, New York.

Report of the Secretary-Treasurer. Moved and seconded that the report be accepted as read. Carried.

Report of the Committee on Revision of the Constitution and By-Laws. On motion, duly seconded and carried, the Report was carried over to the next executive session.

Report of the Committee Representing the American Otological Society, the American Laryngological Association, and the American Laryngological, Rhinological and Otological Society to the Council of National Defense.

Having been asked by the Council of National Defense to suggest in what ways the nose, throat and ear specialists of the societies mentioned can be of use to the Army and Navy Medical Corps, we feel that we can suggest the following:

We recommend that all the members of the American Otological Society, the American Laryngological Association, and the American Laryngological, Rhinological and Otological Society be requested to become members of the Medical Reserve Corps of the Army and Navy, or of the Officers Reserve.

In the first place, the members of these societies could examine recruits for the aviation service, in testing the condition of their labyrinths.

In the second place, we could be of service in examining the upper air tract of recruits, especially in cases of hoarseness or other suspicious conditions which might evidence the possibility of tuberculosis.

In the third place, we could be of service in examining all recruits in whom there was a suspicion of impairment of the hearing, or in which there was any evidence or suspicion of the infection of the middle ear, either acute or chronic. We recognize the importance of excluding chronic suppurative ears, from the experience of the British Army.

We could be of service in the organization of a base hospital for the treatment of cases of injuries and diseases of the eye, ear, nose and throat at the base of military operations or elsewhere.

The younger man or junior is the physician under thirty-five years of age, and the consultant or senior is the physician over thirty-five years.

It is advised that the younger men be utilized for active service in the base or other hospitals, and that the older men be utilized as consultants for one or more base hospitals, or a group of neighboring hospitals.

It is advised that a list of the Naval and Base Hospitals, and Naval Training Stations be obtained, and a list made of the consulting specialists. This list is to be placed in the hands of the Army and Navy officials in order that in case of need the required specialists may be assigned to the various hospitals. The names of these specialists are to be chosen by a committee from the three special societies represented by this committee.

We should like to call attention to the necessity of testing the hearing of men in military service in order to ascertain the type of impairment of hearing that will exclude men from certain forms of service, yet permit them to engage in other forms; and to formulate and publish these tests for the use of the consulting military throat and ear specialists of the country.

We recommend that men furloughed from the front, having affections of the nose, throat and ear, be referred to some

distinct hospital and some designated physician in connection with that hospital, in order that the physician may keep in touch with the soldier or sailor until he is sent back to the line of service.

CHARLES W. RICHARDSON,
Representing the American Otological Society.
BURT R. SHURLY,
Representing the American Laryngological Association.
HARRIS P. MOSHER,
Representing the American Laryngological, Rhinological and Otological Society.

After considerable discussion, it was moved that the Report of the Committee be accepted as read. Seconded. Carried.

Adjournment.

Executive Session.
May 30, 9 A. M.

Call to Order.

There were excuses for absence from the following: Drs. Franklin Stephens, T. Y. Sutphen, C. G. Coakley, J. C. Lester, C. E. Perkins, W. K. Rogers, N. D. Harvey, E. A. Crockett and the resignation accepted with regret of Dr. Percy Fridenberg.

Report of the Committee on Necrology: Moved that the Report be accepted and spread upon the minutes. Seconded. Carried.

DR. HORATIO NELSON SPENCER, A. B., A. M., M. D., LL. D. was born in Port Gibson, Mississippi, July 17th, 1842, and died in Atlantic City, New Jersey, August 8th, 1915.

During the Civil War he was a member of Cowan's Battery, Loring's Division, of the Confederate Army.

He was a graduate of the University of Alabama and the South Western Presbyterian University, and graduated from the College of Physicians and Surgeons, New York City, in 1869. Then followed a period of post-graduate study in Berlin. In 1870 he moved to St. Louis and began the exclusive practice of Otology—one of the very few men who were practicing Otology exclusively at this early date.

Dr. Spencer was admitted to membership in The American Otological Society in 1870, at the Third Annual Meeting, and, at the time of his death, was second in point of seniority upon the list of active members.

In 1879 he established the American Journal of Otology, and remained its editor until 1883.

In 1881 he was appointed to the Chair of Otology in the Missouri Medical College, and when this institution merged with the St. Louis Medical College to form the Medical Department of Washington University, he occupied the same Chair in the latter institution.

Westminster College conferred upon him the degree of LL. D.

Dr. Spencer was one of the pioneers in Otology in this country and his reputation for conscientious work was universally recognized by his confreres, especially of the Mississippi Valley.

WHEREAS, The American Otological Society, at its Fiftieth Annual Meeting, held at Atlantic City, May 29th and 30th, 1917, record the above brief facts of Dr. Spencer's life and record with sorrow the death of one of their oldest members and one of the pioneers of Otology,

BE IT RESOLVED, That the above report of the Committee on Necrology be entered upon the minutes of this meeting and that a copy of the same be transmitted to the family of Doctor Spencer.

NORVAL H. PIERCE.

G. HUDSON-MAKUEN, A. B., M. D., died at his birthplace, in Goshen, N. Y., on February 21st, 1917, aged sixty-two years.

He graduated from Yale in 1884, and from Jefferson Medical College in 1889. He had been an instructor in the Centenary Collegiate Institute of New Jersey and the National School of Elocution and Oratory. In 1896 he was appointed Professor of Defects of Speech at the Philadelphia Polyclinic; he was also Laryngologist and Otologist to the Chester Hospital, Philadelphia; President of the Section of Laryngology and Otology of the American Medical Association in 1902, President of the American Academy of Medicine in 1900, and President of the American Laryngological Association in 1916.

His writings on the defects of speech have been some of the most valuable contributions made to this subject, and are marked by a clearness of expression which commands the attention and keeps alive the interest of the reader.

Dr. Makuen was elected a member of the American Otological Society in 1912.

Dr. Makuen possessed the rare gift of oratory, and his mental spontaneity caused him to be called upon to exercise this gift at many happy gatherings.

Dr. Makuen was a kindly man, a dignified and modest gentleman, and he will be missed at our meetings.

WHEREAS, The American Otological Society at its Fiftieth Annual Meeting, held at Atlantic City, May 29th and 30th, 1917, record the above brief facts of Dr. Makuen's life, and record with sorrow the death of one who had secured a high place in the regard of his confreres,

BE IT RESOLVED, That the above report of the Committee on Necrology be entered upon the minutes of this meeting, and a copy of the same be transmitted to the family of Doctor Makuen.

NORVAL H. PIERCE.

DR. D. BRADEN KYLE of Philadelphia, one of America's foremost authorities on diseases of the nose, throat and ear, died on October 23d, 1916, from pleuro-pneumonia, after an illness of only four days. It is probable that he was a martyr to his profession, as he was in such buoyant health on his return from California, on September 15th, that his associates think he must have contracted pneumonia while treating a patient with an infected throat.

Throughout a successful medical career, Dr. Kyle has not only made a name for himself as a practitioner, but he has gained renown as a medical educator, and his position as an eminent scientist has been established by his many valuable contributions to Medical Literature, which have been received with greatest favor, abroad as well as in America. His Text-book on "Diseases of the Nose and Throat" first appeared in 1899, since when four more editions have been published. In Hare's "System of Therapeutics" (1897) he contributed a chapter on "Diseases of the Uvula, Pharynx and Larynx," and in the American Yearbook of Medicine and Surgery, and American Medicine, he was editor of the chapters on the Nose, Throat and Ear. His contribution to the general and special literature of medicine was extensive.

Dr. Kyle was the inventor of several useful instruments that are extensively used by the profession.

Dr. Kyle was born at Cadiz, Ohio, on October 11th, 1863, the youngest son of Samuel W. Kyle, whose family was one of the oldest in the state, coming originally from Kyle, in Ayshire, and descended from James Kyle, First Vicar Apostolic of Scotland. His mother was of English extraction, being a lineal descendant of Thomas Cross, who came to this country in 1746, and served under Washington in the Revolution.

Dr. Kyle was married December 19th, 1900, to Miss Jeanette E. Smith, daughter of the late Col. Thomas J. Smith of Philadelphia.

His early education was received in a private school. After his graduation from Muskingum College, he entered Jefferson Medical College, also studying Bacteriology and Pathology privately with Professor W. M. L. Coplin, and Nervous Diseases, Anatomy and Surgery with Professor J. Chalmers DaCosta. Throughout his senior year he was an office student of surgery with Professor W. Joseph Hearn, and on his graduation was awarded a gold medal for an essay on "The Pathology and Treatment of Tetanus."

The Autumn after his graduation he was appointed assistant demonstrator in the Pathological Department of Jefferson Medical College, and held that position until 1895, when he was appointed to the Chair of Pathology, which he filled for a year. Meanwhile he had begun to practice in Philadelphia, and established a private laboratory for work and instruction in clinical microscopy, bacteriology and pathology, giving a regular course of three years. In 1894 Professor DaCosta became associated with him, and surgery was added. The Laboratory soon grew to such an extent as to demand more time than could be devoted to it, so in 1896 the course was discontinued, and Dr. Kyle concentrated his energies on investigation in his own private laboratory. In 1896 he was elected Professor of Laryngology in his old college, which position he held until the time of his death.

From 1891 to 1893 he was chief laryngologist, rhinologist and otologist at St. Mary's Hospital, and in the latter year was elected to a similar position in St. Agnes' Hospital.

In 1906 Dickinson College conferred on Dr. Kyle the degree of Master of Arts.

He was a member of the American Otological Society since 1903, The American Climatalogical Society, a member of The American Medical Association, and a Fellow of the College of Physicians of Philadelphia. He was also for some time a member of the Board of Health in Philadelphia.

His opinions are largely accepted as authority in the field of his specialty by members of the profession, his eminent standing being indicated in the fact that in 1900 he was President of the American Laryngological, Rhinological and Otological Association, which met in Philadelphia. Two years later he was chosen Vice President of the American Laryngological Association, which met in Boston, and in 1911 he was elected to its Presidency—the highest honor to be conferred in his specialty.

Dr. Kyle was a great traveller. Every summer he took long vacations and with Mrs. Kyle frequently hunted big game in the Rocky Mountains. He knew well the silent places of Colorado, Wyoming, Montana and British Columbia, and there renewed his strength for the strenuous work of the following winter.

Dr. Kyle was one of the most industrious men in his profession. No effort to cure or save a patient was too great for him to make. He knew no distinction in class or sect, and only differentiated between the rich and the poor to give greater attention to the latter. In spite of an enormous and lucrative

private practice, he never refused a charity case. He would give to the poor and the lowly the same careful attention and contributed to them as freely from the same great skill, as if he were attending the most wealthy or the most prominent families in the country. For his friends, those of whom he was fond, he recognized no bounds as to time and labor. He was a devoted and loving friend, and for those, whom he termed such, nothing was too much for him to undertake or accomplish. He early taught that disease or inflammation of the throat or nose came from a systemic condition, which would yield readily to general treatment, but would be obdurate to simply local applications. He had a habit of operating as early as seven in the morning so that he himself could watch his patient during the day. One of the secrets of his success was that he never left to his subordinates or assistants the care of a patient after an operation. He has been known to travel miles in the country in the middle of the night to take care of his patients. Little children particularly appealed to him and he had an unusual attraction for them. His sweet, kindly nature—his warm, friendly smile—his outgiving of love and affection endeared him to all his little patients. If one of these were ill, there was no trouble or burden too great for him to assume.

With his passing to the Great Beyond, there has been a loss to the community which cannot be filled. There will be other great physicians in his own branch of medicine, but the combination of a great and distinguished physician, eminent author, famous teacher and loving and unselfish friend, such as existed in David Braden Kyle, cannot be found in many generations.

The World is richer for having known him, even for the all too brief half century of his life; the community in which he lived, his poor people and his friends, the little children who loved and depended upon him, and above all, his wife, will day by day and year by year appreciate the loss that they are called upon to sustain—a loss that will not grow lighter as the years roll on.

WHEREAS, The American Otological Society, at its Fiftieth Annual Meeting, held at Atlantic City, May 29th and 30th, 1917, record the above facts of Dr. Kyle's life, and record with sorrow the death of one of their representative men,

BE IT RESOLVED, That the above report of the Committee on Necrology be entered upon the minutes of this meeting and that a copy of the same be transmitted to the family of Doctor Kyle.

NORVAL H. PIERCE.

Dr. Randall reported the death of Dr. George H. Strowbridge, a former member of the Society, and moved that notice of his death be incorporated in the Report of the Committee on Necrology, in appreciation of the position of the deceased as an otologist. Seconded. Carried.

Nomination of Delegate and Alternate on the Executive Committee of the Congress of American Physicians and Surgeons, 1919:

Dr. Charles W. Richardson, Washington, Delegate,
Dr. B. Alexander Randall, Philadelphia, Alternate.

The question of the publication of a medical journal devoted to Oto-Laryngology was introduced by Dr. George E. Shambaugh. After considerable discussion, it was moved that further discussion be deferred for the closing executive session. Seconded. Carried.

Report of the Committee on Membership:

The Committee on Membership of the American Otological Society recommend for membership in the Society: Dr. Gerhard H. Cocks of New York City and Dr. Don Campbell of Detroit, Michigan, and further recommend that in accordance with the By-Laws the consideration for membership in the Society of the following candidates be held over for one year: Dr. R. T. Atkins of New York City, Dr. Stuart L. Craig of New York City, Dr. Samuel McCullagh of New York City, Dr. E. P. Fowler of New York City, Dr. H. H. Briggs of Asheville, N. C., Dr. Benjamin D. Parish of Philadelphia, Dr. William L. Culbert of New York City, Dr. J. E. Beck of Chicago and Dr. Samuel J. Kopetzky of New York City.

The Committee in submitting the report have sacrificed their own personal feelings regarding many of these candidates, but have endeavored to voice what they believe to be the sentiment of the Society, namely, that the Society is now so large and has so many men on its list, who are members in name only, that in the future it should be the policy of the Society to admit to membership only those men who have won their spurs in Otology. The Committee fully realizes that some of the present year's candidates will make valuabl-

members in the future, but for the present, for one reason or another, they do not measure up to the requirements which the Committee contemplates the Society at large now demands. The Committee begs to further state that it is their belief that the members in proposing candidates for membership should carefully consider their responsibility to the Society in their sponsorship.

ROBERT LEWIS, Chairman,
JAS. F. McKERNON.
CHARLES W. RICHARDSON.

Moved that the report be approved and accepted. Seconded. Carried.

It was moved that the Finance Committee be empowered to act to the amount of $150.00 to cover the expenses of the banquet. Seconded. Carried.

Adoption, article by article, and section by section, of the revised Constitution and By-Laws, by motions duly seconded and carried. It was then moved that the Constitution and By-Laws, as thus adopted, be adopted as a whole. Seconded. Carried.

Report of the Business Committee: Nominations for 1917-1918:

President: Norval H. Pierce, Chicago.

Vice-President: Ewing W. Day, Pittsburg.

Secretary-Treasurer: George E. Shambaugh, Chicago

Membership Committee: James F. McKernon, Chairman, George L. Richards, Christian R. Holmes.

Publication Committee: B. Alexander Randall, Chairman, Arthur B. Duell, the Secretary, ex officio.

Attention was called to the fact that the Membership Committee passes out of existence with the adoption of the revised Constitution and By-Laws, the Council taking up the duties of the Committee. With this modification, it was moved that the Report of the Business Committee be accepted, as read. Seconded. Carried.

Moved that the Secretary be instructed by the Chair to cast one ballot for the officers as nominated. Seconded.

Carried. The Secretary, so instructed, cast one ballot for the officers as nominated.

Moved that the Business Committee be released, with thanks. Seconded. Carried.

Dr. B. Alexander Randall, on behalf of the Committee on Under-Graduate and Post-Graduate Teaching of Oto-Laryngology, reported that several meetings have been held during the year, and that good work had been done, looking to high and practical standards. It was moved that the report be accepted, and the Committee continued. Seconded. Carried.

It was moved that the Chair appoint a committee to make nominations for three members of the Council. Seconded. Carried.

It was moved that the old Committee be empowered to make these nominations. Seconded. Carried.

Adjournment.

Executive Session.

May 30, Afternoon.

Call to Order.

It was moved that the President be authorized to have the new Constitution and By-Laws printed and a copy sent to each member of the Society. Seconded. Carried.

Report of the Committee on Nominations of three members of the Council:

Charles W. Richardson, Chairman,
Edward B. Dench,
Frederick L. Jack.

Moved that the Chair instruct the Secretary to cast one ballot for members of the Council as nominated. Seconded. Carried. The Secretary, so instructed, cast one ballot for the members of the Council as nominated.

In accordance with a suggestion from the President that the members contribute a small sum—two to five dollars—to a fund to be sent Dr. Herbert S. Birkett, of Montreal, now in Europe, to be used by him as he sees fit,

It was moved that each member be given an opportunity, by mail, to contribute to a fund to be sent to Dr. Birkett, to be used as he sees fit. Seconded. Carried.

A unanimous vote of thanks was tendered Dr. John B. Rae, the retiring Secretary-Treasurer, for his long and valuable service.

Installation of incoming President and Secretary.

A unanimous vote of thanks was tendered the retiring President.

The question of the publication of a journal devoted to Oto-Laryngology, carried over from the previous executive session, was discussed. Moved that the question be tabled. Seconded. Carried.

Adjournment.

The Committee on Necrology also desire to report upon the loss by death of the following members:

Dr. Alfred M. Amadon of Boston, who was elected to membership in 1912, but because of illness had been unable to attend any of our meetings;

Dr. J. R. Fletcher of Chicago, who was elected in 1915, and who died before the next annual meeting;

Dr. E. C. Rivers, of Denver, Colorado, who was elected in 1906;

Dr. Edmund D. Spear, of Boston, Mass., who was elected in 1884;

Dr. George Strowbridge, formerly clinical professor of diseases of the ear in the University of Pennsylvania and one of our former members and one of the pioneers of Otology who died within the past year.

ROBERT LEWIS,
NORVAL H. PIERCE,
STEPHEN H. LUTZ.

PRESIDENT'S ADDRESS.

By CHRISTIAN R. HOLMES, M. D., Cincinnati, Ohio.

Gentlemen of the Otological Society:—

On behalf of your officers I welcome you to the fiftieth meeting of our Society. While each meeting in the past has been pregnant with splendid work and progress in our chosen specialty, nevertheless it is customary in all activities of human affairs to give special prominence to meetings or events, when certain cycles have been finished, and while events in history are measured by centuries, there is nearly always special importance attached to the period when the semi-centennial milestone of time is reached, and we may be pardoned if at this time we harbor a feeling of pride in this organization, its achievement and what it stands for.

On an occasion like this, our first thoughts naturally revert to the men who, figuratively speaking, laid the foundation upon which the younger men have continued to raise the present structure, and in recognition of their work we issued special invitations for them to be present, that the Society might pay tribute to them on this occasion. The infirmities of age have prevented some from being here in person, but in thought and sentiment they are with us, as I shall have occasion to show at our banquet this evening. We are doubly rejoiced that some of them will grace this meeting by their presence and to them we extend especially a hearty welcome.

As your President, I should have added something to this meeting, that, however little its value might be, would show labor and thought bestowed upon it. I have deferred this for another meeting in the near future. In another year I shall have time to again actively take up writing and investigating, because then I shall have completed what must be the main work of my life, the devoting of fifteen

years in helping to create public sentiment, planning and building the Cincinnati new General Hospital and Medical College, taking our municipal hospitals out of politics and placing them under the control of the University. As President of the Hospital Commission, which had absolute control of the manner in which the $5,000,000 voted by the city or presented by public spirited citizens should be spent, it has been and is still a time-consuming task to see to it that the city receives 100 cents' worth for every dollar spent.

I hope you will pardon me for referring to this and not think me immodest. I beg you to believe me that I mention this in a spirit of humiliation and to show that in carrying on the above-mentioned work I have not been a slacker in the cause of medicine, and this must be my excuse for not having been more of a producer in otology during the last few years and especially during the past year, when in spite of my deficiency you so generously saw fit to place me in the presidential chair, which I realize is the greatest honor an otologist can receive and for which I am deeply grateful.

With our entrance into the European war there have arisen important problems in relation to Medical Education. Through the Medical Section of the Council of National defence, the Deans of the Class A Medical Colleges have twice been called to Washington, where we were in session with the Secretary of War, and of the Navy, the Surgeon Generals of the Army and the Navy, and their associates, in conjunction with the Medical Section of the Council of National Defence. As you are perhaps all aware, we were asked to adopt the speeding-up program, carrying on the Medical Schools during the summer and graduate our present Junior Classes in January, 1918. While this would mean great increase in cost and labor, the colleges unanimously accepted the task, but before we could carry it into effect, the second call came for the Deans to again meet in Washington, and then we were asked not to speed up and not to lower the standard of teaching. This change of sentiment was caused by the advice of the English Commission, who explained what a fatal error England made in this respect.

With the exception of Harvard, the Deans unanimously voted to not give summer courses, as the continuous strain on the students and teachers during hot weather could only result in inferior work and physical breakdown in many instances. A few colleges are going to speed up, but so far as I can see this is the outcome of competition for students among rival colleges. This does not refer to Harvard, for the latter had adopted this before our meetings.

The going forth from the larger hospitals of the Base Units is drawing heavily upon our teaching forces, and in some instances the men who can least be spared are most eager to go. I therefore, on May 4th, addressed a letter to the Surgeon General for definite instructions, and received the following reply on May 6th:

"In reply to your letter of the fourth I will say that the Department believes the faculties of medical schools can render the best service to the Government by continuing in their present position and duty, that is, of supplying the profession with graduates in medicine.

"It is suggested that no member of your faculty whose services cannot conveniently be spared apply for commission in the Medical Officers' Reserve Corps. Co-operation should govern, and this can best be had by the members of your faculty submitting their applications for the Reserve through you. Your indorsement as to whether or not the applicant can be spared from his present duties will guide this office in the matter of the acceptance or rejection of the applicant.

"Members of the faculty who have applied for commission in the Reserve, and whose services cannot be spared, should withdraw their applications or refuse commission upon receipt of the same, giving as their reason for refusal or withdrawal the policy of the Surgeon General's Office, which has the approval of the Council of National Defense, that those members of the faculties of medical schools whose services cannot be spared should not be commissioned in the Reserve."

In order that the Societies of Otology, Laryngology and Rhinology may render service to the Army and Navy, the

Presidents of the Laryngological, Otological and Trilogical appointed a joint Committee of three, consisting of

Dr. Charles W. Richardson, for the Otological.

Dr. Harris P. Mosher, for the Laryngological.

Dr. Burt R. Shurly, for the Trilogical.

Said Committee formulated a splendid list of recommendations to the Council of National Defence, which was duly acknowledged and appreciated, and I feel sure that many workers in the triologies will be called, because of the unusual amount of damage resulting to the respiratory tracts through the use of poison gases, trench and dugout exposure, so well pointed out by President Goodale in his opening address yesterday.

I now declare the Fiftieth Annual Meeting of the American Otological Society open for scientific work and invite any guests who may be present to participate with us in the discussions.

I believe you will agree with me that our able secretary, Dr. Rae, has prepared a well balanced program for your consideration.

THE USE OF PARAFFIN AS A PACKING FOR THE RADICAL CAVITY.

By HARRIS P. MOSHER, M. D., Boston, Mass.

At times it becomes necessary to pack the radical mastoid cavity in order to keep granulations in check. Pressure packing also is resorted to in threatened stenosis of the cartilaginous canal. The merits and demerits of packing and its various forms are too well known to need re-stating. Three years ago I began filling the radical mastoid cavity with diphtheria antitoxin. The theory which prompted its use was the fact that the blood of an animal is destructive to the blood of a man, and there was a possibility therefore that the animal serum might prove antagonistic to the growth of granulations. I used the diphtheria antitoxin because it was easier to obtain. I had it in mind, however, to try next rabbit serum. Some five cases were tried out with the diphtheria antitoxin and excellent radical cavities obtained, the noticeable feature about them being that the epithelial lining was unusually thin judging from the distinctness with which the middle ear landmarks stood out. These experiments were suggestive but not conclusive. I mention them because the idea which suggested the antitoxin in a way suggested the use of paraffin. I was hunting for a substance to use in the radical mastoid cavity which had a known action upon tissue cells. The memory of some of my early cases of paraffin injection for the correction of saddle back nose was painfully clear. In these the paraffin which was used at first too liberally stimulated the growth of connective tissue and led in the end to the production of the opposite deformity for which the patient originally sought relief, he started with a saddle-back nose and ended with a Roman nose. I reasoned that if the paraffin stimulated the growth of connective tissue it might also stimulate the growth of epithelium. The stimulation of the growth

of connective tissue, of course was not desired; it was argued, however, that the pressure of the paraffin would prevent this and at the same time keep down the growth of granulations. The results of the use of paraffin in some five or six cases have been more than encouraging.

Allow me to state at this point that it has been my custom for the last few years to employ a primary skin graft in all cases where it was justifiable, and to use a secondary graft in the other cases. Where partial or complete failure of the graft occurred granulations would eventually spring up, generally first from the inner end of the facial ridge and then the weary fight, weary alike for physician and patient, would begin for their mastery.

The method of using paraffin for packing the radical mastoid cavity. The paraffin first used was that prepared for subcutaneous injection and had a melting point of 110 degrees F. This proved too soft and was hard to get in quantity. The ordinary commercial preparation put out by the Standard Oil Company and to be found in all drug shops, was next used and proved to answer every purpose. It has a higher melting point and when it is in the ear the heat of the body does not soften it so readily. The paraffin is sterilized by melting. When it is partially cooled it is molded into balls about half an inch in diameter and placed in a sterile jar. In order to use the paraffin a ball is dropped into hot sterile water and softened and then broken into two or three pieces. Each piece is then molded into a cone half an inch long, the base of the cone being a little less than the size of the canal of the ear. The radical cavity is then packed from within outward, placing one softened cone upon another in the same fashion that a dentist packs the cavity of a tooth. If the radical cavity is packed with a single piece, the paraffin will not pack satisfactorily, and being irregular in shape, the mould cannot be gotten out without first being broken into numerous pieces. In packing the radical cavity piecemeal, each cone preserves to a certain extent its identity and is more easy to detach and remove. In order to aid the removal of the paraffin the experiment

was tried of inserting a silk thread in the center of the plug. This, however, pulled out and was of but slight if any help in the extraction of the plug. Next an attempt was made to soften the plug by syringing with hot water against the outer end of it. This likewise helped but little. Finally stout forceps were relied upon to morselate the packing and to remove it. The first part of the packing comes out in long strings like gum, while the final pieces generally come out whole, without becoming stringy. It must be confessed, however, that the removal of the paraffin is the fussiest manipulation connected with its use; undoubtedly some better method of removing it will be found if the procedure proves to merit general use. In order to insert and mould into place the cones of paraffin, I have found it convenient to straighten out a eustachian catheter and to close one end of it by winding it with cotton.

In first using the paraffin plug, I was fearful of the effect of pressure on the stapes. No disturbing signs of stapes pressure appeared, and I soon gave up worrying about it. It was soon found that the paraffin plug could be left in place from three days to a week without causing trouble of any kind. The heat of the body causes the wax to melt a little and permits adequate drainage along the sides of the plug. With some people the plug softens more than in others; in one child, for instance, the plug never really became hard. As I said before, the paraffin plug has been used in five or six cases; in all it proved a great help in keeping down the granulations. It was found that epithelium readily grows under it or rather in contact with it, and it has proved to be non-irritating. One case in particular illustrated the non-irritating effect of the plug. In this case the patient who had a nearly epidermitized radical cavity was discharged to the Out-Patient department for final observation and care. When he got home he came down with an attack of acute articular rheumatism and was unable to report for a month. The packing remained in place all this time without causing any inconvenience, and when

it was taken out on the patient's reappearance the whole cavity was found to be epidermitized.

Instead of giving all the cases in detail, five cases only will be spoken of, and these will be summarized. In the first of these four cases the paraffin packing was placed in the radical cavity at the end of the radical operation. The patient had a chronic suppurative ear complicated by a foul postaural abscess. The wound became infected and the incision had to be freely drained. In spite of the infection the paraffin packing was kept in place. The suppuration had cleared up in the usual time and healing apparently was not prolonged by the presence of the paraffin.

In the second case, the operation ended with a small radical cavity and a small exposure of the dura. Naturally it was not considered safe to put in the paraffin packing for some two weeks. When this time had elapsed a bridge of granulations was present from the tip of the facial ridge to the anterior canal wall. The granulations were bitten off and the paraffin packing inserted. The packing was left in three or four days at a time. The granulations were successfully dealt with and the end result was an undeformed cavity.

The third case in which the paraffin packing proved to be of help was as follows: The patient was a young negro who had been operated upon for extensive tuberculosis of the glands of the left side of the neck and the left parotid region. Left facial paralysis and a long standing suppuration of the left ear showed extensive disease of the left mastoid. A far-reaching exenteration of the mastoid was carried out, uncovering an extradural abscess, and a perisinus abscess. Radical cavities resulting from such operations are hard to maintain, but by making a paraffin mold of the cavity and inserting this through the postaural wound it was possible to maintain the radical cavity for some three months until the patient died of tubercular meningitis.

Without the paraffin packing to control the granulations and maintain the cavity so that epidermitization could

proceed from the edges of the wound this would have been a most distressing case to handle.

The fourth case in which the paraffin was of help was a case of carcinoma of the auricle with extension along the posterior canal wall to the drum. The auricle was removed together with a generous area of surrounding skin. The cartilaginous canal was removed entirely. The case was dressed by inserting a paraffin cone in the canal and over this a flat sheet of paraffin the size of the area denuded at the operation. Epidermatization took place normally under the paraffin and the canal has remained open.

The fifth and last case is of a type in which the paraffin plug promises to be an advance over our usual methods of treatment. This patient had a tempestuous operative history, the details of which will be omitted. The essential point for our present purpose is that after the radical mastoid operation the inner half of what was formally the cartilaginous canal narrowed and threatened to become stenosed. In treating this threatened stenosis a style of wire was tipped with absorbent cotton and then the style with its cotton covering was dipped in melted paraffin until a re-enforced plug was secured which was a little larger than the stenosed canal. This stiffened plug was then coated with scarlet red and forced through the narrow canal into the cavity of the middle ear. As the canal opened up the size of the plug was increased. A patent canal of good size was obtained as a result of the persistent use of this method of treatment.

The use of scarlet red in connection with the paraffin plug was spoken of in recording the last case. This brings up the point that the plug can be coated with scarlet red or any medicament which the physician wishes to use. Furthermore, the medicament, boracic acid powder, for instance, can be incorporated with the paraffin as well as used as a coating for the plug.

From the above cases I feel that the use of paraffin packing promises a number of advantages over the old methods

of packing and that it deserves a further trial. To conclude and summarize:

Paraffin makes a useful dressing for the radical cavity. It can be put in at the operation or at the first dressing. Small balls of sterilized commercial paraffin are warmed until they are soft and pliable and are then packed into the radical cavity in the same manner that a tooth is filled. The heat of the body causes the paraffin to melt a little, and experience has shown that adequate drainage occurs along the sides of the filling. The paraffin has proved to be non-irritating, and can be left in place from three days to a week. It checks the growth of granulations very materially and epithelium grows readily under it. As a dressing it is both clean and comfortable.

In treating stenosis of the canal a piece of wire is wound with cotton and then dipped in melted paraffin until the plug is of the right size to fit the canal. As the canal opens up the size of the re-enforced paraffin plug in increased. The paraffin plug can be coated with scarlet red or any medicament which is desired.

Discussion.

Dr. Edward B. Dench, New York City, had used the paraffin mixture suggested by Carrel, but not in just the manner described by Dr. Mosher. He had melted the paraffin and smeared it over the cavity.

Dr. Norval H. Pierce, Chicago, had used paraffin in the ear, for perhaps ten years, for the purpose of stimulating the mucosa of the tympanic membrane. It acted in a remarkable manner in stimulating closure of large old perforations of the tympanic membrane. He used for the application of the paraffin ordinary dressing forceps or any kind of a spatula, the end of which was heated over a Bunsen burner. The paraffin was placed on the end of the spatula, and a thin layer of cotton placed over this, on which has been previously sprinkled some scarlet

real, a little wheel of paraffin being shaped so as to entirely cover the tympanic membrane. This was held in place by means of boracic acid packing. Of course, the edge of the perforation is etched with trichloracetic acid.

Dr. Mosher, in closing the discussion said in answer to a question by Dr. S. MacCuen Smith, concerning the management of the Eustachian tube, that he had given up trying to close the tube. Previous to this he had closed the tube in two cases by putting in a plug of cartilage.

He had tried all sorts of flaps for the radical mastoid cavity, but preferred the ordinary tongue flap.

If paraffin is of service in healing a perforation of the drum, as suggested by Dr. Pierce, it would seem that it should also be of service in an epidermatizing mastoid cavity.

Dr. Mosher had used paraffin in one case in which the dura was exposed, but only after an interval of two weeks.

UNUSUAL CASE OF CELLULITIS OF THE SCALP.

By STEPHEN H. LUTZ, M. D., Brooklyn, N. Y.

The history of this case is the usual one for a simple mastoiditis, but the sequel is the interesting part.

The patient, a child of two years, had rhinitis for two weeks previous to beginning of present illness.

Dec. 4, 1917 was restless all day, the temperature that night was 105°. Attention was not called to the ear until three days later, when it began to discharge. I was called to see the child when this occurred and found well marked signs of acute mastoiditis on the left side and advised immediate operation, which was done that same afternoon.

A simple mastoidectomy was done which revealed a very extensive involvement, a culture was taken, which proved upon examination to be streptococcus (unclassified).

The child was in very poor condition to start with and had a cough (bronchitis) and considerable difficulty in taking nourishment—having frequent greenish stools. After the operation these conditions persisted but the temperature dropped to 99° on the following day—then there was a gradual rise of one degree a day for the next three days caused by involvement of the other ear, incision of the drum was followed by another drop to 99° on the next day, from this time on up to the sixteenth day the temperature never went above 101° and then went up to 105° followed that evening by a drop to 99°, up again next day to 106°.

On Dec. 12, five days following the operation, the left ear, side of head and face were considerably swollen and edematous. At this juncture ½ c.c. of autogenous vaccine was given. The peculiar thing about the swelling that began behind the operated ear was the fact that it would not stay localized; one day it would be found about the ear, the next day over the opposite parietal region, with apparently no con-

nection, no marks of redness, swelling or bogginess connecting the affected ear with the swelling. The swelling was reddish purple and would pit on pressure and became so severe at times as to close up both eyes. The child was continually becoming weaker and weaker without any rise in temperature and when it again rose to 106° on the eighteenth day parents brought child home without much hopes of its surviving.

During this period blood examinations, blood cultures (no growth), physical and urine examinations were made by competent men. Nothing to account for the cellulitis could be found. There was no pus present at any time. After two cycles of about ten days each the cellulitis began to abate and the child went on to a complete recovery. Wet dressings and autogenous vaccines were used. He is now well and in better condition than he had been for a number of months before the operation.

Abscess of Pterygoid Fossa.

W. C., age 37, had been treated for "cold in head" with very free discharge of pus from the right nostril and posteriorly into nasopharynx. Pain just behind mastoid radiating to the occiput. This nasal discharge ceased almost altogether but the pain remained. He then began to have some pain in the upper molars on the right side and after waiting a while went to a dentist. One of these teeth was extracted without apparent help. No involvement of the antrum, shown by puncture and washing. Then a swelling appeared under angle of the right jaw.

I saw him then in consultation and found that he had what appeared to be a large supra-tonsilar abscess, I was sure I felt fluctuation in the external swelling.

The external swelling was opened and pus found at a depth of about one-half inch. With a probe I followed a tract which led into the external pterygoid plate of the sphenoid.

The abscess of the supra-tonsilar region was then opened and this abscess connected with the other in the pterygoid

fossa. This was done without anesthesia as the patient was unconscious. Culture from the pus found showed staphylococcus aureus in pure culture. The next day he became fairly rational and reported relief of pain, but on the following day the pain and headache increased, the next day he showed a beginning cavernous sinus thrombosis from which he died early next morning. No autopsy was allowed.

I believe that a sphenoidal empyema found its way through the wall of the sphenoid sinus through an opening covered only by mucous membrane or similar soft tissue and thence down along the external or internal pterygoid plates and down into the neck by way of the planes of the external and internal pterygoid and constrictors of the pharynx.

Discussion.

Dr. Ewing W. Day, Pittsburg, Pa., mentioned two cases of purulent otitis media and mastoiditis in which the infection had been disseminated by the manipulations of an osteopath. When the pain became unbearable the patients were sent to the hospital. One, a woman, was operated upon, with no untoward results. After a few days there was swelling, cellulitis, meningitis, and death. In the second case the same sequence of events occurred. It was discovered that the osteopath had been visiting the patients in the hospital, and had systematically manipulated them each day.

Dr. Lutz, in closing the discussion, said the case of cellulitis which he had reported differed from any case of erysipelas he had ever seen. He cited a case similar to those mentioned by Dr. Day. The mastoid had been treated by an osteopath for nearly four weeks. When he saw the patient, a little girl, she had an outstanding auricle and a running ear.

INJURY TO THE EAR FROM HIGH EXPLOSIVES.

By J. Gordon Wilson, M. D., Chicago, Ill.

One striking feature of the present war from the medical standpoint is the number of cases seen of loss of speech, of smell, of hearing, of sight and of memory without any objective evidence of an injury or at least of an injury, capable, so far as our present knowledge goes, of explaining the symptoms. How are we to account for these conditions? What is there in this war that distinguishes it from its predecessors? Undoubtedly it is the use of high explosives combined with trench warfare. Men live in trenches or underground for days exposed to wet and cold, and at times owing to the shelling of communication trenches, inadequately fed. In addition there is the strain on the nervous system from anxiety and fatigue. Sooner or later there comes close at hand the burst of the high explosive shell. The effect of the high explosive is a great compression, amounting in some cases to as much as ten tons to the square yard. The soldier is stunned or dazed and sometimes has temporary loss of consciousness. These high explosive shells do not contain bullets; the injuries which they cause are due to the fragments into which they split and possibly 75% of the casualties arise from these. But the damage comes not alone from these fragments. The shells shatter the surrounding buildings and trenches and the debris from these are thrown broadcast with terrific force by the explosion. Not only is the expansive force of the explosive sufficient to kill but it may hurl a man for a considerable distance or bury him under a mass of debris.

Warfare neuroses offer an interesting field of inquiry not only to the clinician but also to the pathologist and psychologist. When an injury affects a particular nerve or group of nerves interfering with motor or sensory impulses the re-

sulting lesion usually can be easily explained. But if there be no local lesion and no known central lesion capable of explaining the symptoms, the problems offered for solution are very difficult. It is the present custom to group all such cases under the term "shell shock."

What is shell shock? Is it a definite organic change in the central nervous system, is it some molecular alteration in the cells interfering or modifying the passage of nerve impulses. Or is it the result of a subconscious manifestation of fright?

Shell shock is a much abused term. It is applied to cases that even on a cursory examination can be said to be suffering from purely emotional symptoms. For instance, a stretcher bearer is applying a first aid dressing, and putting his hand on the wound finds it sinks into a mass of blood. He faints and on recovering is found to be speechless and to have marked tremor. He may or may not have been under shell fire, but obviously his symptoms do not arise from the explosion of a shell. To call such a case shell shock is a misnomer. I suppose one might term it psychic shock. With such cases I do not propose to deal—this is a question which belongs to the realm of psychiatry. I am concerned with cases in which there is the possibility, nay rather the extreme probability, of injury to the central nervous system from the explosion of a shell acting frequently on an organism in which the central nervous system is greatly excited and fatigued.

In considering injuries to the ear and its central nervous connections from high explosives let me ask you to approach the subject with an open mind. Let us dismiss from our mind any preconceived ideas we may have in regard to the term "shock." It is well to bear in mind that even in its best recognized form "surgical shock," the physiological mechanism is unknown. To the neurologist it is a term which conveys a number of very distinct ideas. Above all let us be careful in any inquiry not to use such indefinite terms as "hysteria" and "neurasthenia," in regard to which

many of us have very distinct preconceived ideas with little or no basis.

It is obvious that one result of a shell explosion is the great pressure exerted on objects in the vicinity of the explosion. There is one organ of the body that is specially susceptible to pressure—the ear. It is, therefore, not astonishing to learn that deafness is a frequent result of exposure to shell fire.

In this paper I limit myself to a discussion of the effect of high explosives on the ear and its central connections. There are many who speak of it as *shell shock deafness.* Were I to use a short term I would prefer to call it *shell concussion deafness.*

METHOD OF EXAMINATION.

The following case sheet is filled in on the first examination:

Name ..... Reg. No. ..... Unit .....
Age ..... Previous occupation .....
Complaint ..... Previous condition .....
History of present illness.....
Alcohol ..... Tobacco .....
Nose ..... Nasopharynx .....

	Right Ear		Left Ear
M. T.	.....		.....
Tube	.....		.....
Forks:			
32 dv.	.....		.....
64 dv.	.....		.....
128 dv.	.....		.....
C 256	.....		.....
C 2	.....		.....
C 3	.....		.....
C 4	.....		.....
Whistle	.....		.....
Monochord	.....		.....
Rinne	Weber		Rinne .....
Schwabach	(C or C 1)		Schwabach .....
	Conversation Voice.....		
	Whisper.....		
	Romberg.....		
Equilibrium in Right Foot....			Equilibrium in Left Foot.....
Bending Forward.....			Bending Backward.....
Finger to Finger.....			Finger to Nose.....
Pointing, Left Hand.....		up.....	down... ....
Pointing, Right Hand.....		up.....	down.....
Ataxia.....			Tremor.....
Reflexes.....			Nystagmus.....
Caloric Reaction.....			Rotation Reaction.....
Vertigo.....			
Diagnosis.....			

The cases here given are selected more especially to show the variety of cases than give results of treatment.

Private R. H. Canadian Scottish. Age 28. Total deafness in both ears.

Previous condition—hearing perfectly normal. Uses neither alcohol nor tobacco.

On 18th July, 1916, after two months in France was blown about 10 or 12 feet over the parapet by a shell. Unconscious, came to himself in the doctor's dugout and then totally deaf. Sent to Casualty Clearing Station. On the journey from here to base hospital remembers going on train, but the noise of train gave him a severe headache and can remember nothing till he was in hospital. On boat to England remembers the sea journey all right, remembers landing and going on train but got bad again in train and remembers little or nothing for some days but was told he had to be put under restraint.

Seen September 4, 1916—Mentally bright and clear. Could be examined only for a brief period at a time on account of the fatigue produced. During examination he sweated freely and afterwards suffered from severe headache.

Right ear: tympanic membrane—slight congestion—otherwise normal. Left ear: tympanic membrane, slightly congested—otherwise normal. No perception for voice or forks by air or bone in either ear. Both tubes open.

On summation of stimuli behind right ear perceives C_1 and C_2 fork, distinguishes between them, and can sing the notes approximately, though he does not hear what he sings.

Romberg slight; equilibrium poor; bending bad; pointing good; ataxia none; tremor marked; nystagmus none. When walks with eyes shut staggers and deviates to left. Caloric present in right ear, not tried in left. Taste accurate but weak. Concentric limitation of the fields of vision, more marked in left eye. On account of his condition of easy fatigue and the short period (3 or 4 minutes) we could work with him our attention was directed almost entirely to right ear.

Anesthesia all over body. Objects held in hand are accurately named. Deficient sense of position of arms. Feels second and third fingers when moved but does not feel others; on right hand feels third and fourth.

Treatment given is outlined on subsequent page.

Sept. 14—At piano gets middle C and two octaves below. When whistle blown near right ear feels as if something was "jabbing him like a needle." A large form dropped on the floor behind him produces no perception of sound nor do his eyes or eyelids move.

Sept. 20. Hears whistle very slight in right ear.

Sept. 21. Heard gong this morning. Hears very faintly voice spoken into resonating box but cannot distinguish words.

Sept. 27. All notes heard by right ear on piano except two upper octaves. Still sweats freely while being treated by forks and easily fatigued.

Oct. 4. Sang today tunefully and in perfect rhythm. Does not hear his own voice except when singing loudly. Sensation returning in face.

Nov. 1. In left ear gets normal nystagmus with four ounces of water at 64°—pointing deviation to left, specially marked in left hand.

Nov. 10. With speaking tube (a glass funnel and a piece of rubber tubing) hears very well in right ear and can carry on conversation. Can also hear if one speaks loudly to him without tube. When he speaks he does not shout but as a rule moderates his voice well. He cannot hear his own voice with tube unless he shouts. If sings can hear only loud notes—yet sings accurately. Even when totally deaf did not shout. Can hear 256 over left mastoid but not through tube and with finger in right ear says emphatically that sound goes to right ear.

Nov. 12. Pain in right side of head round the right auricle. No cutaneous sensation in hands but feels deep pressure in palm.

Nov. 20. Rinne is negative in left; increased by putting

finger in right ear. Hears Galton-Edelmann 12; hears 2048 dv., but takes some time to get through.

Monochord—Right ear—bone 37; air 39. The hearing by bone is much sharper and response comes quicker. This test varies from day to day. At times it goes to 40 or 49 by air; and 35, 45 by bone. At times stimulus in right ear does not get 45 cm. but does if it be repeated. In left on bone gets it at 60.

Gelle test: When the fork (C256) is placed over right mastoid and compression by Politzer bag—the sound is dulled. In the left ear the fork is almost completely obliterated. (He now hears C256 well over left mastoid.)

Can hear conversation voice in right ear at about one yard. When he answers shouts as a rule.

Private H. C. L. I. Age 29. Complains of complete deafness in right ear; slight deafness and discharge in left. Previous hearing good.

On June 2, 1916, after sixteen months in the trenches shell fell about four feet from him. Slightly dazed, and completely deaf in both ears, but went on fighting. About an hour afterwards a bullet struck him on the right side of the face, again dazed but not unconscious. No hemorrhage from the ear, no sickness or vomiting. Sent to hospital. Hearing gradually returned in left ear but not in right.

Seen Sept. 15, 1916. Scar on face 10 cm. long, extending from 3 cm. below the outer angle of right orbit, to just below the tip of the mastoid, right lobe of ear shot away, lower fibres of facial cut, small parotid fistula. Right ear—M. T. normal. No hearing for voice or forks. Left ear—perforation and discharge. Hears all the forks above 64. Bone conduction slightly diminished. Rinne—slightly negative. Weber to the left.

Romberg none. Equilibrium good. Pointing good. Ataxia none. Tremor none. Nystagmus none. Caloric in right ear gives normal reaction. Stimulating treatment to right ear.

Treatment as outlined on subsequent page.

Nov. 13. Left ear: No discharge, perforation closed. Hearing for voice normal. Whisper 12 inches. Right ear: Hearing for voice 3 feet.

Gunner R. Australian. Age 43. Complains of complete deafness in right ear with attacks of rotation vertigo.

Previous condition, dullness of hearing in left ear for seven years, right ear normal.

Present illness: On the 30th of July, 1916, serving in 18-lb. gun battery, when battery was struck by a shell. A piece of shell struck him on left arm and back and he was blown three feet and dazed. Has no recollection of anything after this till he found himself in base hospital three days after. Then had hemorrhage from right ear; rotation vertigo left to right; nausea but no vomiting, only free of nausea when lying on stomach. Deaf in both ears. Twelve days later heard band play with his left ear. Gradually hearing came back in left ear. In the right ear has not returned.

Admitted Sept. 14—Right ear: M. T. normal, total deafness. No perception for forks or whistle. Rinne—referred to left; tube open.

Left ear: M. T. normal, all forks above 64 heard, but C2 and C3 heard very faintly. C4 heard fairly well. Voice 2 yards, whisper close to ear.

Romberg not present; equilibrium good, bending back fair. If bends forward and comes erect quickly has vertigo and objects go to right. On walking with eyes shut deviates to right. Pointing irregular; ataxia none, tremor slight, nystagmus none, caloric reaction normal in right ear.

Treatment with forks twice a day.

Sept. 17—Gets C1 by summation of stimulus through right mastoid.

Sept. 20—Gets slight buzzing sound in right ear through the resonating box. Has diminution of bone and air conduction over the whole range of forks?

October 12, 1916—Right ear: Hearing for conversation voice 20 inches. Left ear: Hearing for conversation voice 5 yards.

Private L. Age 31. Complains of deafness in both ears. Previous condition good. Drinks considerably and smokes to excess.

Present illness—In France for six months. August 6, shell burst and plank hit him on right side of head, buried, not unconscious, deaf in both ears, no hemorrhage, no pain, noises in head. After a few days left ear got better.

October, 1916. Right ear—M. T. normal. When examined with Siegel there are areas slightly relaxed. Blood vessels along malleus dilated. No hearing for voice or forks. Left ear—M. T. slightly thickened. Hears all the forks from 64 to C4. Voice 5 feet. Whisper 1 foot.

Romberg none. Equilibrium good; bending good; pointing good; ataxia none; tremor marked; nystagmus none. Caloric reaction in right with four ounces of water at 65°; during the caloric there is marked dissociation in movement of eyes. Marked concentric limitation in fields of vision. Nose and nasopharynx normal.

Treatment as outlined on subsequent page.

Oct. 16—Hears all forks in right ear.

Oct. 31—Left ear, conversation voice at five yards. Right ear, voice heard with noise apparatus in left. In both ears marked diminution in bone and air conduction with all the forks.

Nov. 24—Right ear, conversation voice seven yards. Left ear, conversation voice seven yards

Fields of vision still contracted within 10 mm. ring.

Sergeant L. Age 27. Complains of deafness in the left ear. Previous condition good. Little alcohol or tobacco.

In France from Dec. 1914. Had been under fire from January 6, 1915, until wounded. Previously wounded on leg, April 1915 and on May 8, 1915. Slightly gassed May, 1915.

May 2, 1916—Trench mortar burst (60 lbs. high explosive shell) and hit by piece of shell on frontal bone which pierced his helmet, buried for four hours. When dug out, speechless, no nausea and no vertigo, but left ear totally

deaf, right ear very deficient hearing. Sent back to camp and later invalided to England.

Sept. 6—Right ear: M. T. normal, hears all the forks from 64 up. Bone conduction diminished. Weber to the right. Rinne negative. Hears voice at three yards, whisper four inches. Left ear: M. T. large perforation. No perception for forks. Voice not heard.

Romberg none, equilibrium good, bending fairly good. Finger to finger and nose, good. Pointing, hand deviates to right, ataxia none, slight tremor, no nystagmus.

Treatment—Forks for four minutes twice a day in left ear.

Sept. 21—Left ear: Hears all forks from 128 to C4. Hears voice.

Sept. 27—Right ear: Voice four yards, whisper ten inches. Left ear: voice heard with noise apparatus in right. Perforation closing.

Oct. 10—Right ear: M. T. normal, hearing for conversation voice seven yards. Left ear: Small perforation, hearing for conversation voice one yard. Whisper close to ear.

N. B. Patient reports on Jan., 1917, that hearing is still improving.

The ear stands in a different relation to concussion than any other organ of the body. It is a peripheral mechanism fundamentally affected by varying pressures and specially adapted to register and transform minute pressures into nerve impulses. The nerve impulses are carried to the central nervous system to be there interpreted and utilized. In hearing, the air vibrations in various combinations are transmitted normally through the external auditory meatus to the drum membrane, from there through the ossicles to the middle ear and cochlea. The nerve impulses are conveyed through the cochlea and along the acoustic path to the temporal lobe,—not in one long undivided path but along a path broken at numerous junctions or synapses. At these synapses, communications can be established with other physiological systems. The vestibular system

is another finely adapted pressure mechanism, designed to register and signal to the central nervous system pressures produced by movements of the head. The pressure of the fluid in the vestibular system is adjusted to indicate very small varying pressures. Information so obtained, together with information from other sources enable the muscular mechanism to adapt itself rapidly to varying alterations in our centre of gravity and so to maintain the body in an erect position during movements of the head. Here also we have not one unbroken path but an interrupted mechanism with many complex associations with other paths.

There are certain limits of pressure normal to these two mechanisms. Pressure beyond the normal produces symptoms which are pathological. Such disturbances in connection with the cochlear mechanism may produce hyperacusis, hypoacusis or even total deafness. Disturbances of the vestibular system produces disturbances of equilibrium, for instance, vertigo and nystagmus.

All cases admitted to a hospital from shell shock and suffering from deafness are not necessarily suffering from concussion deafness. Many can be definitely shown to have obstruction deafness, blocking of external canal, rupture of the membrane, etc. But excluding these there still remain a number of cases with the history of deafness following exposure to shell fire in which the changes could not be traceable in whole or part to damage to the conducting mechanism and which must be classed as nerve deafness. These I have been in the habit of dividing into three groups:

(1) Cases of nerve deafness.

(2) Cases in which there had been nerve deafness of a varying degree and in which there still exists the *fixed idea* that they cannot hear, or that the hearing is markedly deficient.

(3) Malingerers. In this class there were undoubtedly some who have had concussion deafness but this has been recovered from; others, however, were malingerers without any excuse. With this group I do not intend here to dwell.

To discuss how they were detected lies outside the limits of this paper.

It is a difficult matter to separate (2) from (3). Experience, the general condition of the patient, his answers to the test question, largely aid one. The following may be given as an example of (2):

Pte. D. S. Severely wounded in head by bullet on May 28, 1916; unconscious for several hours; when recovered consciousness was deaf in right ear. Admitted Oct. 1, 1916, because of deafness. Has a depression (5.2 cm., by 1.5 cm.) in the right parietal bone near inter-parietal suture through which pulsation of brain can be seen. Right membrana tympani slightly retracted, otherwise normal; no hearing for voice or forks. Left membrana tympani normal; hearing for voice and forks normal. No paralysis, no anesthesia, no astereognosis, no tremor, no Romberg.

Eyes—Movements normal; fields normal; fundi normal; vision in both 6/9.

Oct. 6, 1916. Caloric (cold) to right ear; immediately after, heard voices in right ear or room length (7 yards); whisper 20 inches.

It is with the first group that I am here concerned. This first group includes cases where the history points to injury from shell explosion and where the symptoms are clearly those of loss or diminution of auditory nerve function. They may be roughly divided as follows:

(1) Cases of nerve deafness associated with damage to the conducting mechanisms.

(2) Cases of nerve deafness without any visible or demonstrable lesion in the conducting mechanism when they come under observation. This does not preclude the occurrence of a demonstrable lesion at the time of the concussion; in fact, the history of many of these cases shows that this did occur.

(3) Cases of nerve deafness in which the signs point to destruction of the cochlea and of the semicircular canals. This group I shall dismiss briefly. When we found total

deafness, total loss of response to caloric or rotation in one or both ears we did not continue treatment. Experimentally we tried treatment in three or four without any benefit.

The cases I am considering today, which number over 100, are patients who have received their injury some time before seen, 80% from 6 weeks to 11 months, before they came under observation. During that time, many of them were under the care of competent otologists. Some have had "suggestion" of various kinds and some have had electrical treatment.

The symptoms associated with loss of hearing from high explosives are varied and complex. There are present, for instance, headache, sleeplessness, lethargy, tremors, vasomotor disturbance, exaggeration of tendon reflexes. There is unsteady equilibrium with vertigo. There is concentric narrowing of the fields of vision. In many, fields of anesthesia are present. Hyperesthetic areas are occasionally demonstrable. Speaking generally, one may say that we have here symptoms frequently and advantageously grouped under the term "traumatic neurosis."

The pathology of nerve deafness from high explosives is unknown. Mr. Sydney Scott of London has reported a case where after a bullet wound fracturing the vertex of the skull with no paralysis, but great bilateral though not total deafness, the post mortem examination showed intact tympanic membrane, no injury to stapes, or annular ligament, or membrana secundaria; no hemorrhage into the labyrinth, blood clot in both middle ears; no fracture of the base. (Otological Sec. Proc. Roy. Soc. Med., p. 29, March 1916.)

The treatment is founded on the following anatomical and physiological basis:

(1) At the synapses there is structural discontinuity of the nerves.

(2) The results produced by impulses travelling in a nerve depend on the way the fibre ends and not on any difference in the impulses themselves. (Bayliss, Principles of General Physiology, p. 387). The difference recognized by the organism must be due to analysers in the central nervous system. (Bayliss, loc. cit. p. 513.)

(3) At synapses different physiological systems come into touch with each other and so co-ordinate action in diverse systems is possible.

(4) At synapses there is always a spread of the nerve impulse, and the greater the impulse the greater the spread.

With this basis we worked on the following hypothesis:

As a result of the high explosive with enormous and sudden increase of pressure in the ear, there occurs a dissolution of the permanent auditory pathway, and a spread of the nerve impulse into other adjacent paths. The auditory stimulus no longer reaches its goal and deafness results. Such a dissolution may occur at one or several synapses. It may not be complete and a maximal stimulus may still be able to get through.

To help the reestablishing of the normal we have the fact that habit and association of activity facilitate transmission of impulses. Nerve impulses tend to pass over an accustomed and long established path, so the most favorable cases are those in which complete dissolution has not occurred. The most unfavorable are those where there has been complete dissolution and total deafness to tuning fork, voice, and noise, no matter the intensity of pitch.

The treatment pursued is briefly as follows:

(1) Tuning forks are applied at first to the bone (e. g. mastoid). After these are readily perceived sound is conducted through resonators attached to the ear by a tube, and finally through the air. In the worst cases the time given varies with the amount of deafness. Intensity played little or no part, summation of the stimuli was the effective means.

(2) As early as possible the voice is used, at first through resonators with tube in ear, then through speaking tubes, and finally without any aid.

(3) Each period of treatment is short, for fatigue is rapidly produced. If the treatment be too long we may have headache, vertigo, sweatings, etc., and occasionally pain in the ear is complained of.

(4) As soon as possible carefully graduated physical exercises are given. Here the essentials are short duration and no bending.

The treatment (except the drill) is given twice a day in our worst cases, it ought to be given twice in all. In the worst cases when it is difficult to pass from bone to resonator we use the piano. We find that at each successive stage we have to use summation of the auditory stimuli; thus not only must the fork on the resonator be kept up for some time, but with the voice we have to repeat the word, but even then there is often a delay before the response comes. In the later stages the delay is still present. Then it appears to be not so much that he does not hear, but that he hesitates to attach the word to the sound, for if asked what he thinks it is he frequently answers correctly.

In an ear totally deaf to voice, as soon as possible we ascertain if the semicircular canals are active, because when there is reaction to the caloric or rotation tests we feel justified in continuing treatment for some time.

To sum up: (1) The normal stimulus (musical notes or voice) is an adequate stimulus for the nerve and is the best stimulus. Electricity is contraindicated and likely to do harm since it so easily produces vertigo.

(2) In the totally deaf, bone conduction is perceived before air conduction. It is essential to differentiate vibrations from musical notes.

(3) In these cases, summation of stimuli plays an important part in the perception of sound.

(4) There is a marked diminution of the duration of hearing along the whole series of forks—both through bone and air. This corresponds and exists pari-passu with concentric limitation of the fields of vision. Often both improve together. Frequently the field of vision is more retracted on the side having the greater deficiency of hearing.

(5) If the conducting mechanism is damaged or destroyed it not only takes longer to get improvement but complete recovery cannot be expected.

(6) Prognosis is good as a rule especially where there is no trauma demonstrable in the peripheral organ, and a normal caloric reaction. The most noteworthy exception met with so far is damage to the seventh nerve. In these cases hearing returns but slowly and so far as we have observed not perfectly, even with a normal drum membrance, little if any signs of middle ear inflammation, and a caloric reaction present.

Discussion.

Dr. Max A. Goldstein, St. Louis, Mo., emphasized the timely value of the paper. Because of the enormous numerical involvement in the present international war situation, the subject must be developed from every viewpoint. One point, not mentioned by Dr. Wilson, had been brought out at the International Otological Congress at Boston, to the effect that destruction of a large portion of the cochlear nervous mechanism was demonstrable in guinea pigs and white rabbits which were killed after having been exposed to concussion for repeated lengths of time. This seemed to be substantiated to a large extent in the case records presented by Dr. Wilson. In these cases the caloric test did not indicate any great amount of deafness but the cochlea had been interfered with by the constant concussion of high explosives.

If some of the theories concerning the physiological and reconstructive processes in the cochlea be correct, it was possible that the little nerve ends around the cochlea might undergo some sort of reproductive process, and that this might be stimulated by low, sonorous tones and in other ways suggested by the essayist.

The cases might be grouped in two classes: those with concussion alone and those with actual concussion plus gunshot wounds.

Dr. Frederick L. Jack, Boston, Mass., asked Dr. Wilson about the condition of the stapes, about which the latter had

hinted. Mr. Scott made post-mortem examinations in some cases, and his findings would answer the question. The speaker also asked in what proportion of cases rupture of the basilar membrane by concussion had been found, and in what proportion there had been dislocation of the stapes. He had found, in his work on stapedectomy reported several years ago, that wherever there was rupture of the basilar membrane there was total deafness.

Dr. Lafayette Page, Indianapolis, Indiana, suggested the possibility of improvement in some of these cases under consideration through the administration of a general anesthetic. In Penhallow's recent work on "Military Surgery," he reports cases of loss of hearing, sight, voice and memory due to shell shock, with complete restoration of function after administering ether. The speaker referred to cases in his own experience in which loss of hearing, sight and speech due to shock had been restored by the administration of ether. These were not cases of malingering or so called hysteria, but "traumatic neurosis," due to concussion. In the speaker's opinion, the interruption of function in these cases is due to paralysis from shock and consequent retraction of the dendrites which is restored by relaxation from the anesthetic. In other words, the nerve paths are re-established. The observations of the essayist in the field have been most interesting and instructive.

Dr. Eugene R. Lewis, Dubuque, Ia., was under the impression that the underlying cause of the failure to receive sound vibrations was a solution of continuity at the synapses. The synapses are quite susceptible to such poisons as nicotine. It would be interesting to learn whether any predisposition was manifest in history of excessive use of tobacco on the part of those affected; in other words, whether those who used tobacco heavily were more frequently affected than those who used it lightly. He asked if the physiological basis on which treatment rested was not an attempt to restore contact between dendritic processes and at the synapses.

Dr. Wilson, in closing the discussion, said, in reply to Dr. Goldstein, that one must differentiate between noise and concussion. The noise of a pistol shot or the concussion of a shell burst had both an effect upon the cochlea. In concussion there was apparently no permanent damage to the cochlea, otherwise these individuals could not recover. The Gellé test showed that the stapes was not fixed. Recovery of hearing under light ether anesthesia was akin to auto-suggestion. Cases undoubtedly recovered after ether anesthesia as after auto-suggestion. I believe, however, the conditions chiefly discussed in my paper are physiological and not psychological.

He could not answer the question with reference to hemorrhages into the brain. Certainly, as I have verified from my own observations minute hemorrhages are present in a number of the cases in which post-mortems were available. Undoubtedly some of the cases of deafness in sailors were due to concussion. The amount of pressure behind the gun was a matter yet to be determined.

The influence of alcohol, nicotine and syphilis was no doubt of importance. We tried to ascertain the habit of individuals in regard to alcohol and tobacco and in a number of cases the Wasserman test was made. But our figures do not allow any definite conclusions. Treatment was directed to aid the restoration of continuity at the synapse.

RECENT OBSERVATIONS IN OTITIC MENINGITIS.

By S. MacCUEN SMITH, M. D., Philadelphia, Pa.

The recurrent prevalence of influenza each year is an important factor in the development of otitic diseases and particularly their complications. Furthermore, although the patients present the characteristic symptoms of influenza and are treated for such by their attending physicians, when the bacteriology of the discharge taken from the tympanic cavity and more especially the uncontaminated pus of the mastoid cells is determined, it reveals the presence, in a vast majority of instances, of a pure pneumococcic infection, and in those cases in which we find a mixed infection, the pneumococcus usually predominates. In a majority of all the cases that I have had in recent years, a bacteriological examination of the cerebrospinal fluid showed similar characteristics. As the bacillus influenzae has actual recognition as a distinct organism, it seems curious that its presence has been but seldom found in any of my cases. Hence the question naturally suggests itself: Did these patients in truth suffer from a pneumococcic infection, the symptomatology of which closely resembled that recognized as characteristic of influenza?

On the authority of Dr. Randle C. Rosenberger and Dr. S. Solis-Cohen, who have made an extensive study of the bacteriology of patients suffering from so-called influenza, a strictly influenzal infection is decidedly rare except when occurring in definite epidemic form, and even then the bacillus influenzae is found in only a small precentage of cases treated for this disease.

In considering this subject, Dr. Thomas McCrae states that "the term influenza is used with two distinct meanings. Strictly speaking, it should be limited to an infection definitely due to the influenza bacillus, but in general usage it is employed to designate a wide range of acute infections, which may occur in epidemic form or sporadically. The epidemics of recent years apparently have been due especially

to the pneumococcus or the streptococcus. Clinically there may not be much difference between the two and only a bacteriological examination may settle exactly what the infection is. It is altogether likely that in some cases, also, another pyogenic coccus, and occasionally the micrococcus catarrhalis, are responsible. I fancy that the term influenza in its wider meaning is pretty thoroughly fixed and that we cannot expect it to be restricted to infections which are definitely proved to be due to the influenza bacillus."

Notwithstanding present diagnostic methods and the development of various surgical procedures for the relief of otitic meningitis, I am still constrained to the belief that it continues to be the most fatal disease that we, as aurists, are called upon to treat. Indeed, there is, perhaps, no ailment to which human flesh is heir wherein the mortality is so great. The recent contributions by Crockett (1) have been received with the same enthusiasm as was formerly accorded those of Haynes, describing his operation for draining the cisterna magna. There is this difference in the results of these two procedures, however, that some of Crockett's cases have actually recovered, whereas it is doubtful if any recoveries resulted from the Haynes operation.

Otitic meningitis presents two formidable conditions which must be met and successfully combatted before relief of this grave disease can be accomplished. The first is intracranial pressure and the second is bacterial invasion of the blood stream. All of our investigations and experiments have had this attainment in view. The final goal, however, has not been reached, for although some measure of success has been secured, the net results are so far unsatisfactory and inconclusive.

We all recognize the desirability of an early diagnosis, and yet it would seem impossible to anticipate the development of otitic meningitis in some cases; for instance, three recent

1. Crockett, E. A. "The Treatment of Acute Leptomeningitis of Otitic Origin in Early Operation and Subdural Drainage, with Report of Six Cases." Trans. American Otological Society, 1909.
"The Relief of Otitic Meningitis by Subtemporal Drainage, with a Report of Two Cases of Recovery from Streptococcus Meningitis by This Method." Trans. Am. L. R. & O. Society, 1916, p. 173.

patients became unconscious within twenty-four hours after the initial ear lesion and never recovered consciousness, succumbing in from twenty-four to forty-eight hours. Examination prior to operation showed the spinal fluid cloudy, with absence of sugar, high cell count, and the presence of the pneumococcus. In each instance the spinal fluid was under greatly increased pressure, and there was also marked retraction of the head.

From the above it would seem that our best means of securing an early diagnosis would be the practice of a more frequent examination of the spinal fluid, in aural patients, even though we do not suspect the presence of a meningitis. This suggestion is not entirely new nor by any means visionary, as I believe that we should uniformly secure the data incident to such an examination prior to all of our radical mastoid operations. On more than one occasion meningitis has been demonstrated by this preoperative precaution, in spite of the fact that the patients did not present a single meningitic symptom, and in view of this fact I feel justified in suggesting a more routine examination of the spinal fluid in certain forms of aural disease. Not many years ago spinal puncture was considered not only a major surgical procedure, but by some authorities even hazardous. With improved modern technic, this operation has become very common, and as untoward results from the same must be very exceptional, I consequently feel justified in this recommendation.

As stated above, inflammation of the meninges causes dangerous intracranial pressure, together with a bacteremia, so that our efforts must be directed toward the relief of these two conditions. Therefore, drainage by any efficient means is our best method of offering relief, but most difficult of accomplishment. Some cases are reported as having recovered from meningitis by simple decompression; others, from a combination of decompression and drainage, as suggested by Crockett;[1] while in still other instances recovery has taken

1. Crockett, E. A. Loc. cit.

place simply through the performance of the mastoid operation. In each and all of these instances the patient probably would have died had it not been for the apparent efficiency of lumbar puncture.

Numerous forms of internal medication have been suggested and employed, but apart from those used for the purpose of sustaining the patient's vitality and building up his resistance, I have failed to obtain any benefit that I can definitely attribute to this line of treatment. Much has been written about and claimed for autogenous vaccines and other forms of sero-therapy, as well as large doses of urotropin injected into the spinal column. The latter has proved wholly ineffectual by all methods of administration. It is quite a common practice to give urotropin in various doses by the mouth. However beneficial this practice may be in genito-urinary diseases, I have long since discontinued it in aural affections, principally owing to the fact that if we are not able to secure beneficial results by the injection of sixty or more grains into the spinal column, it seems unreasonable to hope for benefit through other means of administration. Furthermore, as a rule the use of urotropin by the mouth has a decided tendency to cause gastric disturbance, thereby interfering with nutrition.

I have been unable to secure curative effects through the employment of sero-therapy, but good results are frequently reported, and inasmuch as this seems to be our only reasonable means of combatting the bacteremia, I believe that autogenous or other suitable forms of vaccines, or the Hiss leukocyte extract, should be employed, though their efficiency is not as yet definitely established.

In the fulminating type of acute meningitis, in which death results in from twenty-four to forty-eight hours, the immediate cause is, perhaps, the rupture of a brain abscess into the ventricles.

The usual case of purulent meningitis terminates fatally in about one week, but we should not overlook the fact that patients frequently suffer from a chronic meningitis which

may extend over several weeks, and, more particularly, that latent form of meningitis in which very few, if any, symptoms are present, but which may assume an active form either as the result of an accident or from the disturbance caused by a radical mastoid operation; hence the importance of having a lumbar puncture at the time of the mastoid operation is manifest.

Given a case of suppurative aural disease, it is not only a safe but a reasonable attitude to suspect the existence of meningitis in the presence of severe headache and a rise in temperature. If, in addition, an examination of the cerebrospinal fluid shows increased pressure, bacteria, a high cell count, absence of sugar, the presence of serumglobulins and a definite increase in the polynuclear percentage, the diagnosis of purulent meningitis would be unqualifiedly established and would call for immediate surgical intervention, as well as the administration of other therapeutic measures.

February 9, 1917, I examined E. C., a girl ten years of age. She suffered from a suppurative otitis media of the right side four years previously, which recovered itself in about one month. Two years later she had a similar attack, from which she also recovered in about a month. Again, in two years, came the present attack of acute suppurative otitis media in each ear, with spontaneous rupture of each membrana tympani within twenty-four hours. Subsequently, for about ten days, the patient had considerable pain over each mastoid and also in the temporal and frontal regions, during which time she was treated by an aurist. Three days before I saw her she showed a double convergent strabismus. The day before the operation she was more or less indisposed, as had been the case from the onset of her illness, but this did not interfere with her usual restricted activities. She retired that night without presenting any unusual symptoms except a one-degree rise in temperature. At 1 a. m., she had two violent attacks of vomiting, about half an hour apart. An hour later she became unconscious, with rigid neck, marked double convergent stragismus, legs flexed on abdomen, and

cried out when the skin was touched. She gave plus reflexes in both extremities, Babinski sign both sides, as well as Kernig sign, and marked dermatographia.

The child was taken to the Germantown hospital and a radical mastoid operation was performed on the right side on account of the extensive necrosis, and a simple mastoid operation on the left. A perisinus abscess was found in the latter. Because of the apparently healthy condition of the tegmen antri and tegmen tympani, and the child's critical state, no further operative intervention was deemed advisable at that time. At the end of the following twenty-four hours the patient was semi-conscious. This condition continued for an additional three days, during which she gradually regained consciousness and thereafter improved uninterruptedly and was discharged from the hospital, cured, at the end of twenty-two days from the date of operation, with the exception of a continuation of the paralysis of the left external rectus muscle.

On admission the temperature registered 104°. It immediately declined after the operation and was, thereafter, of no special significance.

The blood examination showed a hemoglobin of 58 per cent., a leukocytosis of 13,600 and a polymorphonuclear percentage of 83.

The spinal fluid was under pressure, cloudy, and showed serumglobulins, absence of sugar and many pus cells.

Cultures from the spinal fluid and from each mastoid showed a pure pneumococcic infection.

Examination of the eyes showed lid action, both eyes, normal. Closing of right eye probably voluntary to avoid diplopia. Apparently slight left-sided paralysis. Slight inequality of pupils, the right a little smaller; both react to light and accommodation. Ocular movements of right eye full; left, paralysis of external rectus muscle. Ophthalmoscope shows, both eyes, media clear, discs fairly well defined, no swelling of discs. Ophthalmic findings indicate basilar meningitis on left side.

This case is of especial interest to me from the fact that

it is the first patient whom I have ever seen recover from a suppurative meningitis as the result of any line of treatment, and while the laboratory findings and other confirmatory evidence support the diagnosis of suppurative meningitis, I believe it to have been definitely circumscribed, from the fact that the patient finally recovered. It is of interest also to note that the operative intervention was confined to a mastoid operation, although I had anticipated doing a decompression, with drainage, after Crockett's suggestion, as soon as the patient's condition warranted.

On the morning of December 18, 1916, I was called to see Mr. H. B., 45 years of age. Found him unconscious, with retracted head, eyes partially opened, and markedly stertorous breathing, presenting the following history: In the evening of the second day previous he had had a slight left-sided earache, which he thought was due to scratching the external auditory canal. This pain was relieved by the instillation of warm boric acid solution. Without symptoms, a slight serosanguineous discharge made its appearance on the afternoon of the following day. Later, at midnight, he suddenly developed an intense general headache, with great restlessness. The attending physician administered one of the coal-tar products, and the patient fell asleep. Early the next morning his wife was awakened by his stertorous breathing and found it impossible to arouse him. It was then that I was asked to see him and had him removed to the hospital and performed a mastoid operation. The cortex was exceptionally hard and thick. The underlying cells were broken down and bled freely. Free pus was evacuated from the mastoid antrum. There was a carious exposure of the dura through the tegmen antri and tegmen tympani. A decompression operation with drainage, after Crockett's method, was performed. The patient died in thirty-six hours.

An examination showed the cerebrospinal fluid to be under pressure, with high cell count, absence of sugar, and the presence of serumglobulins. A blood examination showed a leukocytosis of 19,400 and a polymorphonuclear

percentage of 89. No ocular changes were observable in an ophthalmologic examination. Cultures showed a pure pneumococcic infection of the spinal fluid and mastoid process and pneumococcic and streptococcic infection was shown in secretion taken from the external auditory canal.

Although it would be unusual to subject the patient to an earlier lumbar puncture than was done in this case, yet I feel confident that the findings here would have demonstrated the presence of meningitis two or three days earlier.

January 5, 1917, Mrs. N. K., aged 43 years, was admitted to the Germantown Hospital in an unconscious condition, with retracted neck and knees flexed on abdomen. She had suffered from an attack of influenza for about ten days, and had early developed a suppurative otitis media, with spontaneous rupture. She was said to have almost recovered from the influenzal attack, and the day previous to her admittance to the hospital was performing her usual duties about the house, when the headache, which had been slight, suddenly became very severe and she lapsed into unconsciousness almost immediately.

The eye examination was negative. Examination of the spinal fluid showed it to be under pressure, with high cell count, absence of sugar, and presence of serumglobulins. Cultures showed a pneumococcic infection of the spinal fluid, mastoid process and middle ear. The temperature chart showed no significant feature.

A mastoid operation was performed on the right side, with exposure of the dura through the tegmen antri, the center of which was decidedly dark. An incision provided for the escape of considerable cerebrospinal fluid. The patient succumbed the following day without recovering consciousness.

It was decidedly unfortunate that we were unable to secure an autopsy in either of these cases, and this, in my opinion, is one of the most serious handicaps in the advancement of American surgery, for without autopsy we are totally unable to confirm our diagnosis.

Discussion.

Dr. Francis P. Emerson, Boston, Mass., reported a case of circumscribed meningitis which illustrated the fact that there may be no symptoms or group of symptoms to indicate the outcome. The prognosis depending on the virulency of the organism. The patient, who was seen by him in consultation, had been subject to headache for over a year, and had been operated on by the surgeon in charge for suppurative ethmoiditis of both sides. Positive Kernig, stiffness of neck, choked disc, photophobia, positive Babinski, cerebrospinal fluid under pressure, cloudy, with a cell count of 4500 to 6000, were the findings when he examined the patient. On three counts, smear and culture the cerebrospinal fluid showed streptococcus mucosus infection. During an attack of acute purulent otitis media the same organism was found. Later there was an attack of erysipelas. The culture was passed through a rabbit. The rabbit lived, as did also the patient. He thought the case one of old, circumscribed meningitis.

Dr. Ewing W. Day, Pittsburgh, Pa., thought the status of knowledge concerning otitic meningitis was about what it had been for a number of years. One surgeon would report good results from one operation, another from another, while some would report that they could do nothing with any method of treatment. As a matter of fact one did not know what was going on inside the skull. Every operator had a certain number of cases of meningitis that got well. There were many cases, in his opinion, not suspected, that went on to recovery. He had had a number of cases during the past year, every one of which died, and in every one of which pus, in large quantities, was found at the base. With pus in that locality, no matter what kind of drainage one might employ, the patient would die. He did not believe it possible to cure meningitis if the infection got down to the base. The virulence of the organism *plus the location* of the *infection* was the keynote of the whole question.

Dr. Edward B. Dench, New York City, did not agree with Dr. Day's statement; he though a great deal was being learned about meningitis. He had changed his view entirely during the last ten years. Meningitis could not properly be pronounced of otitic origin or secondary to an acute purulent otitis media merely because an inflamed ear and inflamed meninges were coincidental. The two might be concomitant conditions. It was difficult to say that an adult patient has not at some time had purulent otitis media. He had had cases in which the otitis had cleared up and months later symptoms of meningitis had occurred, operation establishing the correctness of the diagnosis. A great deal had been learned with reference to the cell count. Formerly he had thought a high cell count signified that the patient had meningitis and would die. In the last two years he had seen cases in which there was a cell count running into thousands, in which practically nothing except a simple mastoid operation with large dural exposure had been done, and in which, nevertheless, the patients recovered.

The question raised by Dr. Page, as to whether the exposure of the dura made a change in the blood count, could be answered in the affirmative. Almost invariably an increase in the cell count followed exposure of the dura.

Lumbar puncture should always be made prior to either the radical or the simple mastoid operation. Fewer unfavorable results would occur if this were done.

One of his assistants had reported before this Society, last year, a case in which labyrinthectomy was performed on a cell count of about 110 or 120. He considered this a case of meningitis which had been cured by labyrinthectomy. Other cases with a high cell count, occurring later, recovered without anything more than a radical or simple mastoid operation being done. In a case similar to the one mentioned he did not do a labyrinthectomy and the patient died.

Urotropin, in his experience, administered in large doses, internally, had given good results. He had found serum treatment of no benefit whatever.

Dr. Frederick L. Jack, Boston, Mass., cited a case, previously mentioned before the Society, which proved positively that purulent meningitis sometimes recovers without operation. The meningitis followed a middle ear infection, and when he was called in consultation he said the patient was in extremis and probably would not live through the night. The man did live, however, for two years, when suppuration in the other ear was followed by meningitis and death. The record of the case was looked up at that time, and the previous history revealed the fact of recovery from meningitis on the opposite side.

Dr. Smith, in closing the discussion, reiterated the fact that he, like the majority of those present, had tried all sorts of treatments in these cases of meningitis, usually with the result that the patients died. Some of these experiences were very sad. The cases of two private patients, seen by him in consultation, were cited as instances. Both patients presented about the same symptoms. Examination of the cerebrospinal fluid showed meningitis, in the sense that meningitis was usually recognized from these examinations. The patients were not very ill, and the families could not realize the situation. Consultants were called. In one case operation was performed, in the other none; both patients died.

In the Crockett operation, one should be careful, as suggested by Dr. Dench, not to injure the pia mater.

The strain of pneumococcus used had been obtained from the Rockefeller Institute, and was supposed to have been worked out in a thorough way, yet all the patients had died.

He had been induced to bring up the subject again, after an experience of many years without seeing a case recover, except the one above cited.

DOUBLE OTITIS MEDIA: SUBMILIARY PULMONARY TUBERCULOSIS.

By EMIL AMBERG, M. D., Detroit, Mich.

Miss E. W. R., 19 years old, consulted me December 19th, 1916, on account of difficulty in hearing in her right ear, which interfered with her work as bookkeeper. The patient, an anemic girl, was very anxious not to miss any work and not to lose much time.

She said she had been hard of hearing in her left ear for four months, and that recently she became hard of hearing in her right ear. The right ear became much worse the day before yesterday. The right drummembrane was injected, and when the right ear was syringed the fluid went into the throat.

On the left side there was a chronic middle ear suppuration lasting for several months. If I remember correctly, the discharge was offensive and very scanty.

Patient has been hoarse for a long time.

The next day patient came again. I heard a slight hacking cough. The temperature by mouth was 101.2° The general appearance of the patient did not correspond to the picture of an otitis media and its complications. I, therefore, asked the patient to have her chest rayed. Report on Roentgen examination December 20, 1916. (See Figure No. 1, Drs. Hickey and Evans.)

"Stereoscopic plates were made of the chest. We would report that there is a very definite fine infiltration scattered quite universally through both the right and left lung. This assumes the form of very small snowflake-like deposits. This, we think, should be classed as a diffuse, submiliary tuberculosis."

(Signed) W. A. EVANS.

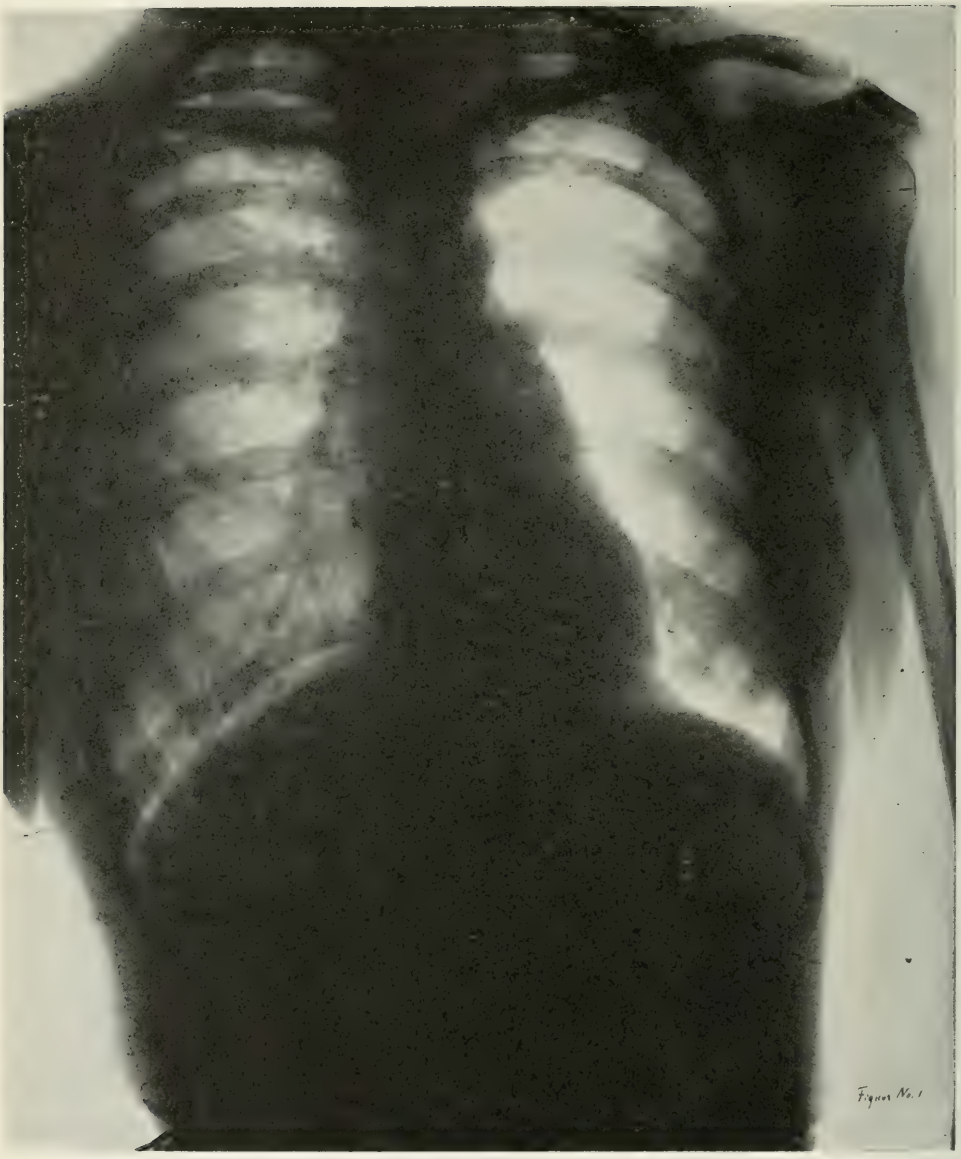


Fig. I.

I advised the patient's mother to have the girl enter Harper hospital, which she did December 22nd. From the Harper hospital records, the following may be mentioned:

December 28, 1916, Wassermann negative.

December 29, 1916, Report of Roentgenologist. (See Figures 2 and 3.)

"Plates were made of the right and left mastoid. The right mastoid shows rather a large crisp pneumatic mastoid, some of the cells of which are quite large and fairly well spaced. The left mastoid does not appear nearly as crisped; the outlines are indistinct. We would think that there was an exudate constituting probably a first degree mastoid."

(Signed) WM. A. EVANS.

December 22nd, 1:15 P. M.; T., 99°; P., 96; R., 20; patient complained of sharp pain in head, ice bag applied to head, examination of chest and back made by Dr. Wehenkel at 7:30 P. M., Sod. Salicyl. gr. V. Phenacet gr. II. Cod. Sulph. gr. ¼, at 9 P. M., feeling much better, headache much relieved. Unable to obtain specimen of sputum.

December 23rd, 8 A. M. Incision of right drummembrane. At 2 P. M., complained of severe pain in head. Medication ordered, by Dr. Wehenkel, containing Sod. salicylate Phenacetine, Codeine phosph., camphor monobrom.

Similar medication was given on subsequent days until about December 31st, when Sod. salic., and Phenacetine were discontinued. Aspirin grains V. was given January 3rd, 1917, once; January 4th, twice; January 5th, once. These medications, among others, are mentioned only because the temperature and pulse may have been influenced to some extent by the same.

The nights, up to January 4th, were as a rule comfortable: from January 4th to 5th, the patient slept very little; from January 6th to 7th, patient was very restless; whereas from January 7th to 8th, patient had a very good night, but not a very good night from January 8th to 9th.

January 5th. Patient unable to talk, left hand twitching. At 8 A. M., pulse weak and irregular; at 12 noon, patient cyanosed, respiration heavy. January 8th, 7:40 P. M., respira-

Fig. 11.

tion shallow; at 8 P. M. patient was unconscious, and passed away at 9:10 P. M.

Dr. A. M. Wehenkel, who occupies himself particularly with tuberculosis, kindly examined the patient, prescribed for her and reports as follows:

"*Family history:* I did not learn anything about her family.

Past history: Three years ago she had an attack of coughing—began to lose weight—had lost considerable weight in a short time; had frequent attacks of cold. It was then called "bronchitis," the cough persisting. Had several attacks of pleurisy during past three years. She temporarily recovered until last fall, when took "fresh cold"; the cough was renewed; she began to lose weight; P. M., fatigue set in, pain in right side aggravated by long breaths, blood tinged sputum occasionally; night sweats; fever in evenings; an incessant cough set in. Some nights she would cough all night without any sleep.

Meningeal symptoms: She developed a headache which was gradual in onset and progressive in severity; she vomited occasionally, not associated with nausea; she was constipated constantly; after four or five days her eyes became somewhat fixed, double vision; she began to have pain in her spine, with a little stiffness in her neck; when I saw her last there was no Kernig's sign; temperature rise in evening.

Physical findings: Larynx, mouth and nose were negative; the expansion of chest was diminished on both sides, but more lagging on the right side; no depressions; on palpation the right side showed an increased fremitus extending over the upper two lobes quite marked posteriorly between fourth and sixth interspaces.

On percussion both apices were retracted, more marked on right, percussion note dull over middle lobe posteriorly; the resonant area was quite high on right side posteriorly.

Auscultation: Breath sounds over right apex were diminished with high pitch and prolonged expiration to fourth rib anteriorly; posteriorly to about seventh, harsh respiration over upper left lobe, scattered crackling rales over entire right

Fig. III.

base of lung, vocal fremitus much increased over middle lobe posteriorly; fine rales were present over left apex. In conclusion I would say that she had a bilateral infection. The condition was a fibroid tuberculosis involving both sides for some time quiescent and which had become very active undoubtedly taking taking on a miliary form with an extension to the meninges.

Owing to the very high temperature it is possible that she had an accompanying secondary infection."

Additional remarks: While writing the paper, I learned from a friend of hers that about two weeks before going to the hospital friends met the patient at a party, where she complained of pain in her ear (which?), and that a physician told her that she needed rest more than anything else, that other friends commented on her white complexion, with a bright red spot on each check. The same friend visited her in the hospital two or three days before she died. She looked a long time at the friend and said: "Why, is that Rena? I can hardly see you."

The mother says that the patient always complained of headache, and that she had irregular menses. In May, she started with a severe headache, she never complained to her about earache, always headache, except when she was in the hospital when the right drummembrane was incised.

The mother says that during the last week the patient saw double with and without her spectacles. An aunt was sitting on a chair and the patient thought the aunt was sitting on the floor.

Patient could not see well without glasses but she did not have double vision before she entered the hospital.

A few days before patient came to me she said: "After Christmas I am going to take an inventory of myself, I have not got a well spot on me, I ache all over." She thought the office would not get along if she were not there. Twice she was brought home after having fainted, once after leaving the street car, once in the office. The mother also reports that the daughter never told her anything about the left ear for

fear she would send her to a physician, but the mother learned from a friend of her daughter's that the patient complained for a long time, now and then, of quite severe pain in the left ear, but that the ear did not discharge.

The patient had also complained that the whole left side of the body felt numb.

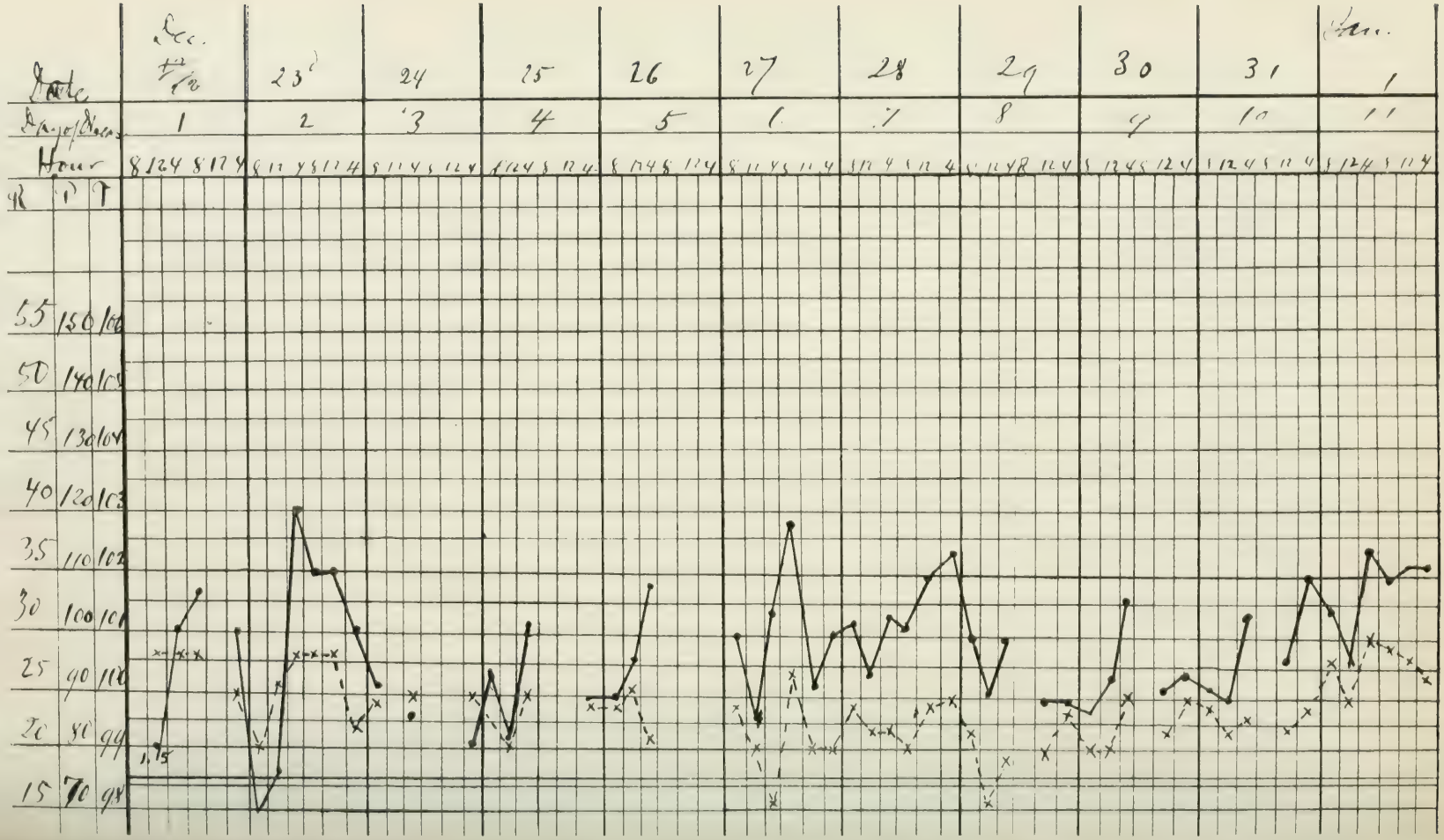
Summary: The patient consulted me on account of a disturbance in her right ear which interfered with her work. The patient was entirely unaware of the seriousness of her general condition even to the end. (Her employer told me that he had warned the patient for some time to take care of herself.) The finding in her lungs at once reversed the whole viewpoint on account of the bad prognosis. On account of the miserable condition of the patient some of the routine examinations which would have been made, were not made. The lumbar puncture might have been the most important one from a diagnostic standpoint. The symptoms on the part of the brain and its coverings were characteristic for meningitis. A gradually developing cloudiness of the mind, more or less severe remitting headache, constipation; on December 29th, tenderness on pressure, not so much over left mastoid as in surrounding tissue, (probably part of a general hyperesthesia). January 4th, creeping pain in neck, relieved by hot water bag). January 2nd, a complaint that she can see but cannot make out anything.

It must be considered what importance must be attributed to the disturbance in the left tympanic cavity and mastoid process, also, whether the meningitis resulted therefrom, or, whether the tubercular trouble was aggravated by the presence of this focus, or, whether there existed no relation between the two conditions.

Concerning a possible exploratory operation on the left mastoid (see also X-ray report) there may perhaps be a difference of opinion. Dr. D. P. Mayhew in a paper before the Wayne County Medical Society, Detroit, May 14th, 1917, reported a number of operations, including mastoid operations, which have successfully been performed in Colorado on

patients suffering from tuberculosis. Whether such a grave general condition as that found in our patient would have permitted an operation on the left side, even if the same had been much more clearly indicated, is very doubtful, especially at this stage of the general disease.

An autopsy was not performed.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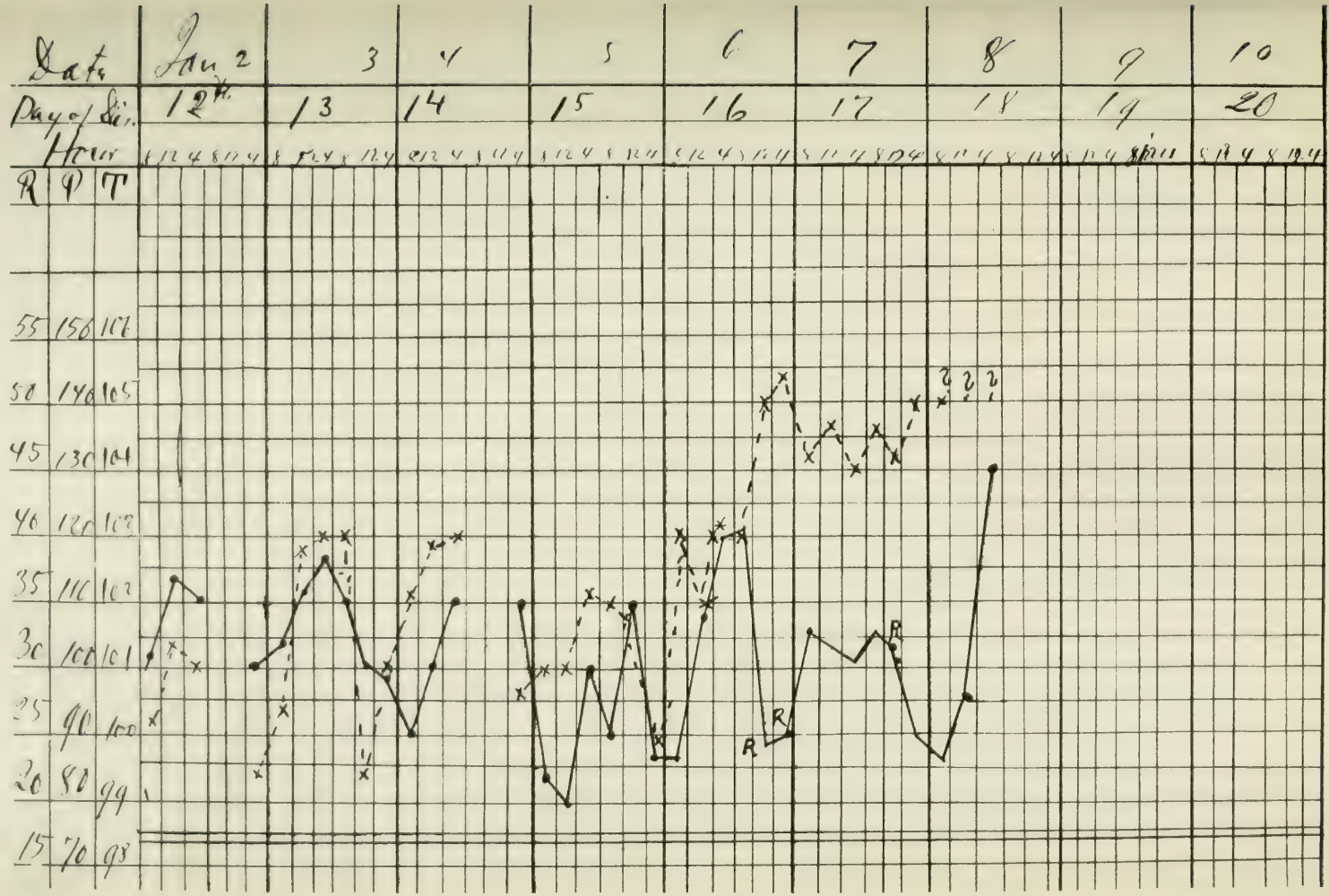
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8 00		98	100.2	100.4	100	101	101.2	101	99.8	100.2	101.4	101.2	101.4	100	99.4	99.6	101.6	99.6
A. M.		80	88	92	88	88	88	84	80	88	96	92	104	112	100	120	132	140 ?
12 00	1.15 p. m. 99	98.6		99.2	100.6	99.6	100.4	99.6	100.4	100	100.6	102.4	102.2	101	99	101.8	101.4	100.6
Noon	96	92		80	92	80	84	72	80	84	90	104	118	118	100	110	136	?
4 00	101	103	99.6	101.2	101.8	101.4	101.4	101	101.6	101.4	102.4	102	102.6	102	101	103.?	101.2	104
P. M.	96	96	90	90	82	72	84	78	90	86	100	100	120	120	112	120	130	?
8 00	101.6	102				102.8	101.2				102		102		100	103.2	101.6	
P. M.	96	96				94	80				98		120		110	120	136	
12 00		102				100.2	102	100	100.2	100.6	102.2		101		102	Rect. 99.8	Rect. 101.4	
Noon		96				80	88	80	84	84	96		84		108	R.34 140	132	

RADIUM IN DISEASES OF THE EAR.

By THOMAS J. HARRIS, M. D., New York, N. Y.

The decade from 1895 to 1905 has been described by someone recently as the most remarkable in history for the number of great primary discoveries. It was near the beginning of this period (1898) that Professor and Madam Curie made the startling announcement to the scientific world of their discovery of a new metallic element which they called "radium" and gave a description of its wonderful powers. Since that time the element has been exhaustively studied and today we are fully acquainted with its physical properties.

Soon after its discovery the medical profession was attracted to it, and it has been tried in one form or another in the treatment of almost every ill to which the human flesh is heir.

In the field of oto-laryngology it has been used chiefly in the treatment of diseases of the larynx, and Polyak, Killian, Abbe, Freudenthal, Coakley and the writer among others have employed it more or less extensively in that domain of medicine. So far as its employment in diseases of the ear is concerned, the literature is very scanty. Most of the work has been done by German otologists and is characterized by their usual thoroughness and care. These reports show that radium has been employed in the treatment of almost every form of ear disease during the past ten years. It has seemed to us that the present time is a fitting one to inquire what it has accomplished and just what we may fairly expect of it.

Properly to answer this question it is desirable that we should recall briefly some of the more important physical qualities of this metallic element.

In the first place, as is well-known, radium resembles the solar spectrum in giving forth three principle kinds of rays

which are distinguished from one another by their varying power of penetration and by the difference in the effect produced. The alpha ray is so feeble that it penetrates scarcely, if at all, beyond the skin. The beta ray is stronger, but the greatest depth of penetration is obtained with the gamma ray, a distance of from 9 to 10 cm. The alpha ray has a decidedly cauterizing action, a quality which is entirely lacking in the gamma ray which possesses the peculiar quality of the metallic element in destroying tissue. For therapeutic purposes therefore the alpha and the soft portion of the beta rays should never be used. A failure to recognize this fact has led, as we shall see later, to serious error on the part of at least one of the observers who has reported his results, and is sufficient in itself to disqualify his findings.

To secure the proper therapeutic result then, it is necessary that the radium should be screened. It has been found that even a thin screen of paper is sufficient to cut out the alpha rays. To exclude these and the soft beta rays however a filter made of lead usually has been employed. Only second in importance to the character of the rays used is the dosage to be employed. This demands much experience, and in many cases, no little judgment. In small dosage radium stimulates tissue growth. In large doses it is a destroyer of tissue. Undoubtedly many of the failures reported are due to the fact that not a sufficient sized dose was used, or what is equivalent, a small dose was not used for a sufficiently long time. Another important point is as to how often the applications should be made and how many in all will be required. Here authorities differ. In the German clinics the small dosage has been the practice repeated bi- or triweekly for a period of from one to three months. In this country, we have believed more in the massive dose applied at longer intervals and then for only a few times.

It is as true of radium as we know it to be of salvarsan that we are dealing with a powerful and dangerous agent, so we should never lose sight of the fact that we may do harm with it as well as good. Personally we have seen no

ill results, but recently we have been informed of a case where radium was applied to the larynx externally for carcinoma with the disappearance of the growth, but where later a stenosis of the esophagus has developed.

All the investigators who have employed it in the ear have made use of the metallic element itself and not of the emenations which have been used elsewhere with such good results. Only so far as superficial growths of the ear are concerned would the observation apply that the skin is disposed to carry away the radium energy, and so with advantage can be frozen or otherwise treated to avoid this.

One of the unsettled questions in connection with radium is exactly what takes place in the disappearance of the growth. One theory that has been frequently advanced, especially in the case of malignant growths is that the element heightens autolysis. Another striking fact is that pathological tissue is far more susceptible to the radium ray than normal tissue. It would appear that in large doses the radium causes a necrosis of the tissue.

Among others who have studied the effect of the drug on the ear are Ewald and Marx, who conducted a series of experiments upon the labyrinth. Their work was independent of one another but agrees in showing that, applied in the auditory canal of guinea pigs, it causes a complete loss of hearing. This, it is interesting to remark, often did not take place immediately, but sometimes several months after the introduction. Marx found post mortem complete destruction of the organ of Corti.

With this short introduction let us consider in detail the various clinical reports on the subject which we have succeeded in assemblying. First, as to the results obtained in *chronic deafness.* Here the case reports are so mingled that it is impossible to divide these into those cases dependent upon middle ear disease as distinguished from where the internal ear was alone or chiefly involved. Ten men have reported their results. Of these three only make favorable reports. Hugel in Germany, Lake in England and Bryant in this country.

Hugel's work was done in Passow's Clinic in Berlin and his results are so remarkable as to receive the designation from one of his critics of "being a fairy tale." He made use of the radium without any screen and employed five mg. from one to two minutes upon the mastoid or for half a minute within the canal.

Lake's experience with radium is limited to a single case of otosclerosis where applications of one-half a mg. introduced for twenty minutes in a silver tube in the auditory canal at intervals of four days gave marked improvement to the hearing.

The report of W. Sohier Bryant appears in the N. Y. Medical Record for 1914 and is a careful analysis of twenty cases or forty ears where he has employed the metallic element. These forty ears are divided into nine cases of otosclerosis, twelve of atrophic middle ear catarrh, thirteen of residual O. M. P. S., three of hypertrophic middle ear catarrh and two of nonsuppurative labyrinthitis. His results show improved hearing in thirty-three ears, decline in hearing in one, unchanged in six. These six were cases of residual O. M. P. S. There was marked improvement in fourteen ears,—six atrophic, two hypertrophic, one nonsuppurative, three otosclerosis; in six ears there was a restoration to normal of the hearing. These represented two following O. M. P. S., two hypertrophic middle ear, two atrophic O. M. C. C.

Bryant also gives in detail (N. Y. Medical Journal, July 4, 1914) the report of a case of middle ear deafness caused by chronic suppuration where radium was employed with benefit to the hearing and the tinnitus which was present. The patient was a woman of 54, who had been operated upon for recurrent mastoiditis and chronic middle ear disease. She complained of loud and persistent tinnitus. The hearing was lost in the left ear and greatly reduced in the right. Radium was applied at intervals of five or six days, presumably three applications in all. Five mg. of mesothorium bromide were used. "After the first application the tinnitus was relived. After the last application it stopped and has never returned. The patient hears the voice now apparently well. Her in-

tellect is clear, and from a person almost totally deaf and indifferent she became observant and responsive."

The remaining seven observers failed to obtain satisfactory results. Of these Passow Dreyfuss, Hegener, Bruhl and Henlein followed accurately the technic of Hugel. Bruhl used eight mg. carried deep into the canal in a lead filter without improvement to the hearing. Henlein's study is a careful one. Only one case in his series showed any improvement by actual functional tests. Passow is strongly of the opinion that it is of no value for the improvement of the hearing. Albrecht applied it in nineteen cases of hard hearing; eleven otosclerosis, two chronic middle ear disease with tinnitus, two chronic middle ear without tinnitus, four disease of the inner ear. No improvement in the hearing was obtained in any of them.

The most careful and exhaustive report in the literature is that of Victor Urbantschitsch. In addition to employing radium for many other conditions he gave it a careful trial in chronic deafness. Seventeen cases of hard hearing, many of them with an old perforation permitting introduction through the drum were treated with radium. Five showed no improvement at all. Twelve he describes as "naherverfolgt." It is his conclusion that good results have been secured and can be secured in such cases occasionally, but, on the whole, the results are poor.

Fraser in an extensive report on the use of radium at the Royal Infirmary in Edinburgh refers to two cases of otosclerosis and one of chronic middle ear deafness where radium was used without benefit. He is of the opinion that nothing can be expected from its employment in such cases. What comment is to be made upon these several reports?

In the first place, they are limited in number. The work in most of them, however, has been carefully carried out so that we are able to draw a pretty fair conclusion. The first thing that strikes us is the striking discrepancy between the findings of Hugel, Lake, Bryant and the others. The report of Mr. Lake, while it is decidedly encouraging, concerns a solitary case, and the important factor of suggestion has ap-

parently not been taken into consideration. To this Henlein has given the weight to which it is entitled. In the series of cases which he studied, the treatments were part of the time with the lead filter alone without radium, and at other times with the radium in the filter. With each method he succeeded in getting improvement in the hearing subjectively, and he reached the conclusion that suggestion and hysteria were accountable for the remarkable results which Hugel reported that he had obtained in his patients. He directs attention also to the fact that, with the application of the radium only to the mastoid, as Hugel did, a penetration deep enough to affect the internal ear was impossible.

If we exclude the case of Mr. Lake and regard as discredited the findings of Hugel, the only favorable report is that of Bryant. No one will for an instant question the sincerity of our fellow-member, and a perusal of his article cannot fail to leave the impression that his work was conscientiously done. Accurate tests however are wanting in the cases reported and it may fairly be questioned whether we all would agree with the diagnoses which were made, and also with the results which were obtained. Here, as in Hugel's case, always the possibility of suggestion has to be borne in mind. So far then as hard hearing is concerned, we are forced to the conclusion that radium has been of no material benefit.

II. *Tinnitus aurium.*

Hugel, Henlein, Brühl, Albrecht, Bryant and Urbantschitsch report results in the use of radium in the treatment of tinnitus aurium.

Hugel has had the same satisfactory responses which he reports in chronic deafness. We have already referred to the unreliability of Hugel's statements. Henlein, however, who has done his work with great thoroughness, makes a decidedly encouraging report. There was a lessening of the noise in eight cases where radium was employed with an increase of the noise in only one.

Albrecht's results with radium, so far as tinnitus is concerned, were also encouraging. For the relief of intractable

tinnitus he made use of the work of Ewald and Marx, and with the permission of the patient, succeeded in destroying the auditory nerve by the employment of radium in two cases. Everything had been tried for the tinnitus in the first case without relief, and finally, at the request of the patient, 23 mg. of radium were placed upon the promontory wall for thirty minutes for eight days. After five applications the hearing which remained had been entirely lost, together with the disappearance of the tinnitus.

The second case was an old radical with a severe tinnitus. Here there was no hearing except for the loud voice. Together with the tinnitus there was severe vertigo. There was a normal labyrinth. After four treatments of from thirty to forty minutes with twenty mg. of radium, the tinnitus entirely disappeared after two and a half months. Objectively there was complete deafness, with a dead labyrinth.

Brühl reports the employment of radium in a similar manner with destruction of the auditory nerve and cessation of the tinnitus. We have already referred to the relief of the tinnitus in a case reported by Bryant, where improvement in the hearing also was secured.

Six cases were treated for tinnitus by Urbantschitsch. In three it was lessened or relieved. Urbantschitsch's conclusions in this respect are the same as in regard to the benefit which may be expected from its use in chronic deafness, namely, that occasionally good results may be secured, but usually they are poor.

From these several reports we may conclude that radium offers more encouragement for the relief of tinnitus than when it is employed for the relief of hard hearing. Particularly does it seem indicated in intractable tinnitus where relief is imperative and where in the past a surgical destruction of the auditory nerves was necessary.

III. *Vertigo.*

The reports are meagre in regard to the use of radium in vertigo. One of the two cases of Albrecht's previously referred to, where he employed radium for destruction of

the auditory nerve suffered from severe vertigo as well as from tinnitus. The relief to the vertigo after four treatments of 23 mg. was just as complete as it was for the tinnitus. The case of Brühl in which he made use of radium with the same end in view was relieved of the vertigo at the same time as of the tinnitus. Finally Dreyfuss reports two cases where the vertigo disappeared from the use of a weak preparation of radium, .6 mg., used for fifteen to twenty-five minutes. It is clear here that no destruction of the auditory nerve was sought for or effected. Even with these few reports we are warranted in concluding that radium can be employed with hope, if the condition is severe enough to justify the destruction of the labyrinth.

IV. *O. M. P. S.*

Urbantschitsch reports a case of chronic suppuration continuing after the radical operation, where epidermization and cessation of the discharge were secured in four sittings by the use of 17 mg., introduced in a film of rubber and paper. He further states that occasionally good results can be secured in chronic middle ear suppuration, especially in the tubercular ears of children. Here he has employed radium emanations with prompt results. In three cases the granulations were caused to disappear. In one case with caries present there was a healing of the caries fourteen days after the application of the radium. In three other cases of middle ear suppuration there was a drying of the discharge without a positive cure. Dreyfuss reports six cases of chronic middle ear suppuration in which a cure was secured in three. He was altogether unsuccessful with the use of the emanations in these cases. In this group of cases, as in those of vertigo, the reports are too few to warrant any sure conclusions. The most that can be said is, that the results of Urbantschitsch, who was a most careful observer, are encouraging.

V. *New Growths.*

Finally as to the results obtained in the treatment of new growths. It has been, as is well known, chiefly in the treatment of new growths that radium has been employed.

Superficial cancer has, wherever situated, responded favorably. The literature in regard to the results obtained in cancer of the ear are equally satisfactory, provided that the cancer is located externally. Urbanschitsch reports a case of epithelioma of the ear muscle which was cured after repeated treatments extending over three months. The patient was a man of 73. The growth was a centimeter and a half in diameter and rapidly extending. Here 19 mg of the radium were employed. The exposures were one to three hours. Recurrence and death occurred within a year.

The second case was one of sarcoma of the ear muscle in a patient of 40 with a node in the auditory canal externally, the size of a pea. Treatment one to three hours caused disappearance of the growth.

The third case was one of tuberculosis of ear muscle and canal and was cured.

The fourth case was one of lupus of the ear muscle with a possible cure.

Urbanschitsch states, that so far as the appearance of the ear after the employment of radium is concerned, the result is all that can be desired. The larger question is whether radium is of any value in deep-seated cancer of the ear. Upon this subject unfortunately the literature is entirely lacking. A personal communication from Dr. Burnham of the Howard Kelly Hospital states that he has treated a number of cases of epithelioma of the ear with radium, and those in which there is not an extensive involvement of the bone and periosteum do very well. He does not state whether the epithelioma were entirely superficial or not. Presumably that is the case.

Dr. H. H. Janeway of New York reports that he has had virtually no experience with radium in malignant disease of the ear. One case of carcinoma of the external auditory meatus, where it was employed, did not do very well. His experience with external epithelioma of the ear is encouraging. We know of only one case beside the one which we are about to relate where it has been used for a malignant growth

situated inside the auricle. This is a case reported by Dr. Joseph Bissel of the Radium Sanitorium of New York, and was a man of 40 years. The epithelioma was a small one in the exterior auditory canal. Five applications of radium ten minutes at each seance completely relieved him of any apparent disease. It is too early to speak of the possibility of recurrence.

The history of our own case is of more than usual interest.

The patient is a man of 30, who was first seen four years ago complaining of difficulty in hearing which had existed for two years. He was not aware of any discharge and there was no history of previous suppuration. There had been a nasal operation the preceding year. He stated that there was occasional pain in the affected ear. Examination gave complete loss of hearing in that ear. The eustachian tube was open. There was a negative caloric and negative turning, showing that the labyrinth was dead. At the first examination there seemed to be a distinct deposit on the drum membrane. This later proved to be only a thickened and reddish drum. The landmarks could not be made out. There was no perforation of the drum and paracentesis failed to bring about discharge. A diagnosis was made of chronic labyrinthitis. In the course of the following month the pain in the ear increased and there were recurring attacks of hemorrhage. At this time an easily bleeding growth was recognizable, springing apparently from the floor of the canal. The canal seemed to be full of cholesteatomatous material. An X-ray picture showed apparent bone changes in the mastoid, and an operation was decided upon. This was performed in April, 1913. The removal of the growth from the canal was attended by severe bleeding. The examination of the tissue was not entirely satisfactory, but pointed to malignancy. (The report has been lost, so we are unable at this time to state whether it was epithelioma or sarcoma.) Prompt recovery took place, with no recurrence of the growth. Nine months later, while the drum could still be seen, there was a soft, non-bleeding mass on the floor of the canal. At this time an

interesting complication presented itself, namely, a complete paralysis of the left vocal cord. The only explanation for this seemed to be in a metastasis into the glands of the chest, with pressure on the recurrent nerve. An X-ray picture of the chest, however, was entirely negative. The Wassermann blood test was also negative. The growth in the canal seemed to be three-fold, on the floor, on the anterior wall, and on the posterior wall. The patient was not seen then for a year and a half. On May 9th, 1916, a slight paralysis of the left upper eyelid had developed. He could only close the eye with difficulty. There was also partial paralysis of the facial muscles on the affected side. The voice was strong, although no change had taken place in the character of the paralyzed cord. Slight discharge from the ear was present. The growth now completely filled the canal. The drum was not visible. A second Wassermann was taken, and was also negative. It was evident that any operation must be extensive and the outcome far from encouraging. It was accordingly decided to employ radium. Two treatments of thirty minutes of 25 mg. of radium produced a distinct shrinking in the size of the growth. There was no reaction. Three further treatments followed, also without reaction. The patient was seen next in October, 1916. During the summer he had continued in perfect health. Examination showed that the growth in the ear had not increased. If anything, it was smaller. A further course of three applications of radium was made. This time the amount used was the same (25 mg.), but the time of the application was increased to one hour. The growth has continued slowly, but distinctly, to recede, although at present the canal is still filled with the growth, beginning some distance inside of the external orifice. The patient has had no pain and very little discharge, and is able to do his work as a clergyman without any difficulty. It would be far from right to state that the case is in any sense cured, but in the patient's opinion, and our own, we feel that radium has given results far in excess of anything that could have been secured by

radical surgical invention, and it is proposed to persist in its use.

Conclusions.

As a result of our study we regretfully are forced to the conclusion that radium, up to the present time, has failed to be of any considerable benefit in the treatment of diseases of the ear. So far as chronic deafness is concerned it has proved virtually a failure. In the rare cases of intractable tinnitus and excessive vertigo, on the other hand, it can be employed with a reasonable hope of relief by its power of destroying the labyrinth. Finally, so far as malignant growths are concerned, it is of value when they are superficially seated. When deep-seated there is nothing sufficiently encouraging to be said of it to warrant its use to the exclusion of operative measures where they can with propriety be adopted. The work that has already been done with it on the ear is not enough to condemn it "in toto" however and it is to be hoped that other investigators will take it up and give it further thorough and careful trial.

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Discussion.

Dr. Edward B. Dench, New York City, had been particularly interested in that part of Dr. Harris' paper which dealt with the treatment of vertigo and tinnitus without operative interference. Many patients were willing to do anything to get rid of the tinnitus, and if this could be accomplished by means of radium it would be a distinct advance. His only experience with radium had concerned the treatment of malignant growths. In one case, seen by him in consultation with Dr. Abbe, the patient was kept alive for three years following a radical operation. At the time of his death there was a slight recurrence. Radium certainly controlled the growth and gave the patient a comparatively happy life. In another case, in which the first symptom was facial paralysis, round-celled sarcoma was found, involving the ossicles and extending to the zygoma. The external carotid was ligated, a large radical flap made, and the disease removed as far as possible. Since that time radium had been used in the zygomatic fossa, and the growth controlled.

Dr. Wendell C. Phillips, New York City, recalled a case, reported two years ago, of primary carcinoma of the external auditory canal. The patient had fallen into the hands of a general practitioner who performed a simple mastoid operation, mistaking primary carcinoma of the canal for mastoiditis. Radium was used by Dr. Abbe, with deleterious effects. The pain and suffering were greatly aggravated after each application, and the growth developed more rapidly than before radium was employed, progressing to a fatal issue.

Dr. Philip Hammond, Boston, Mass., had found radium inefficacious in the treatment of chronic middle ear affections. Three years ago, in association with Dr. Crockett, he had used radium emanations at the Huntington Cancer Research Laboratory, with negative results. The cases treated included otosclerosis and catarrhal inflammation of the middle ear. The technic employed, however, was faulty, the emanations

being simply inserted in an ordinary aural speculum, thus, of course, not reaching the drum membrane. Later he had obtained a small globule containing mesothorium bromid, and had succeeded in carrying this down to the drum membrane in cases of otosclerosis. Considerable reaction resulted, on account of the alpha rays. In some instances there was actual blistering of the epithelium. In not one case was the treatment a success.

Dr. Ewing W. Day, Pittsburg, Pa., had carried out a series of observations, three years ago, at the request of the Pittsburg Radium Institute, using as high as 100 milligrams of the radium salts. The observations extended over three or four months. The only case in which any improvement was noted was one of otosclerosis. There was apparently marked improvement in this instance. Before this treatment was instituted the patient could not hear a clock strike in the room; afterward she could hear the door bell and the clock, and could hear well enough to go to church. When he tested her in the office he found that there was not so much improvement as she thought. The patient insisted on continuing the treatment long after it had been abandoned in all the other cases. Finally, however, her delusion faded, and she concluded that she was no better than before. Tinnitus seemed to be slightly improved.

Dr. Harris, in closing the discussion, regretted having to make an unfavorable report concerning an agent in which considerable hope had been placed. He reiterated the point that radium should not be employed to the exclusion of operative interference, but might be tried following operation. As Dr. Phillips had suggested, there was danger not only that no benefit might result but that actual harm might be done by the use of radium, unless very carefully safeguarded. The possible psychic effect was always to be borne in mind.

THE KINETIC LABYRINTH.

By E. ALEX. RANDALL, M. D., Philadelphia, Pa.

Technicalities, however essential to explicit statement of our subjects, are repellant to most people and hair-splitting differentiations are to be deprecated: even a change from accepted terms, as in the designation of a non-sclerotic otosclerosis, has its opponents and is considered pedantic. Yet when such terms embody essential errors and so confuse a subject as positively to interfere with progress, there is call for purging our nomenclature. This seems the case as to our Barany work; and Vienna, while giving us so much that we must be thankful for, can be charged with some mis-teachings. And when men further complicate such errors by adhering to obsolete anatomic terms, a protest and suggestion seem in order.

There is no evidence, anatomic or physiologic, that acoustic function exists in the vestibular maculae or the ampullar cristae—all are supplied by the so-called vestibular nerve, although the "pars media" of Schwalbe does join the cochlear in its passage through the internal auditory meatus. No real differentiation of its labyrinthine terminals is as yet physiologically possible; and we can only suppose that the saccular macula and the posterior crista have functions exactly parallel to the anatomically similar end-organs in the utricle and other ampulae. We may say, then, that all hair-cells of the end-organs associated with the neurones of Scarpa's ganglion and their neuraxial paths are equilibratory—only those connected with the spiral ganglion of the cochlea are auditory.

As to the non-acoustic labyrinth we have grown accustomed to the descriptive phrase "static". This is probably correct as to the primordial ear-apparatus—if, indeed, in the Medusa, in which it first differentiates, there is any more than this to represent the ear. The eye in coincident development is only

a pigment-spot, unable to do more than distinguish light from darkness; and it is hard to believe that the aural hair-cells can discriminate the vibrations which to us would be sonorous from those merely palpable. Yet the otolith-apparatus of the Medusa may be quite as efficient an end-organ as the similar mechanism in higher animals. Each otolith, acting as a plummet, can indicate the direction of gravitation and fully subserve this actually *static* function.

Only in the higher and more mobile forms of life is there motion rapid enough to require for the safety and success of the animal an apparatus for its perception and analysis—then we find development of a semicircular canal apparatus. This is at first a single tube with an ampullar end-organ at each extremity: in the higher forms it becomes the three tubes at right angles to each other which we know in man. The otolith apparatus develops into the macular areas in the two vestibular sacs; but the tiny "otoconia" which, imbedded in their gelatinous "membrane," are poised above the hair-cells are probably too small to furnish by their inertia any very definite response to motions—they can serve merely the static function, showing the direction of gravitation.

If man is ever to devise a stabilizer for his aeroplane, he must probably copy the semicircular canal apparatus, much as he has imitated the eye in his camera. Each of the tubes constitutes with its utricular connection a complete circle, through which the endolymph can flow in response to movement affecting the head in its plane. A nervous end-organ is needful, therefore, only at one end of each canal where the ampullar expansion makes room for it; and upon this "crista" it is in some cases readily demonstrable that twice as many hair-cells can be counted on the vestibular side as on the opposite (or vice versa), giving the explanation (Eugene Lewis) as to why the reaction is twice as great when the "endolymph-current is up in the upper canal", for example, as when in the opposite direction. The cilia of the ampullar hair-cells are swayed and stimulated by this flow—the more perhaps thanks to "the cupola", if this be not a mere artifact

—and the dendritic fibrils convey the stimulus to the neurones of Scarpa's ganglion, whence they are relayed towards the brain-stem.

In the naming of these semicircular canals the misnomer "horizontal" for the external canal has been a serious stumbling-block, even more than the more erroneous calling of vertical canals "frontal" and "sagittal". Many have taught that all labyrinthine nystagmus is *rotary,* in contrast to the rectillinear oscillations of ocular causation; whereas if we incline the head 30° forward so as to bring the external canal exactly into the horizontal plane, we can get by rotation a strictly horizontal nystagmus. If the external canal is 30° out of the horizontal, neither of the other canals at right-angles to it and to each other can be truly vertical; so they had better be called the "superior" and "the posterior", which they certainly are as truly as the former canal is "external". Their planes, while transverse and longitudinal to the axis of the petrous pyramid, are about midway between the sagittal and frontal planes—the exact direction depending upon the brachycephalic or dolichocephalic index of the skull. The superior of the one side is, of course, approximately in the same plane as the posterior canal of the other side. Accepting Flourens' law that the phenomena of semicircular canal irritation are in the plane of the stimulated canal, we see that we will always get composite effects, unless by exact placing of the patient's head we limit our stimulation to the one canal to which our tests are meant to be directed.

The paper was illustrated by diagrams of the aural apparatus in the ascending forms of life, by macroscopic preparations of the labyrinth in man, and by crania in which the semicircular canals were worked out, showing the difference in the directions of the canals in the broad, and long types, respectively. Later lantern-slides were shown giving the development of the labyrinth from the primary otic pit to the full-formed otolith apparatus of the adult and the ampullar crista with its hair-cells.

AN ATTEMPT AT SIMPLIFICATION OF THE PHYSIOLOGY OF THE VESTIBULAR LABYRINTH.

By ISAAC H. JONES, M. D. Philadelphia, Pa.

When Father Adam first turned to the right, the endolymph in his semicircular canals lagged behind, relatively to the left. His sight and muscle-sense informed him that he was turning to the right; consequently he came to interpret endolymph movement to the left to signify that he was turning to the right. He always turned *away from* the endolymph, and for this reason he recognized endolymph movement in one direction to mean that he was moving in the opposite direction Each child born of Adam passes through the same experience—he learns to interpret impulses from the labyrinth just as he comes to interpret stimuli received from the retina. Images on the retina are upside down, but in course of time the child learns to reverse this image in his consciousness and to realize that the external object is right side up. Similarly through countless repetitions he comes to recognize that endolymph movement in one direction means that he is moving in the opposite direction.

When an individual moves past external objects, his *eyes* attempt to fix upon certain objects as they pass. He does this in the attempt to stabilize the sensorium. When traveling in a railroad train his eyes fix upon telegraph poles and other objects as they pass—consequently his eyes move in the direction of the passing object. Similarly, when he is turning to the right, his eyes, although closed, have been trained to move to the left in the direction of the external objects which are moving to the left.

Experimental stimulation of the ear, by turning in a revolving chair or by douching with cold or hot water, produces an artificial movement of the endolymph. After an individual is turned to the right a sufficient number of times

to cause the endolymph to catch up with the movement of the body, he feels that he is standing still if his eyes remain closed, whereas he is actually turning to the right. As there is no movement of the endolymph in relation to the hair-cells within the ear, his interpretation is that he himself is not moving. Now if the chair be stopped, the endolymph by its momentum continues to move to the right; he therefore feels that he is rotating to the left, although he is actually sitting still. If the right ear be douched with cold water, the chilled endolymph moves downward to the right and the individual feels that he is falling to the left.

I think we all realize that at the present time among otologists at large there is a general impression that the ear-tests are extremely abstruse and difficult, and that the busy otologist must devote years of study to this one particular subject before he is able to conduct these tests. Surely it is the newness of the work that alone is responsible for this misconception. So far as we have been able to determine, the entire subject of responses to labyrinth stimulation may be summed up in the following few words: Eye-pull, past-pointing and falling are all in direction of endolymph movement.

1. The eyes are always drawn in the direction of the endolymph movement.

2. Vertigo is always in a direction opposite to the endolymph movement.

(a) Past-pointing and falling, being in a direction opposite to the vertigo, are therefore in the direction of the endolymph movement

Past-pointing and falling are not reactions to ear stimulation. They are the objective evidence of the subjective vertigo. An individual past-points to the right *because* he feels that he is moving to the left, away from the external object; he falls to the right because he feels he is falling away from the vertical position, toward the left. The eye movements and the vertigo are the two direct responses to ear stimulation. Incidentally nystagmus, vertigo, past-pointing and falling always occur in the plane of the endolymph

movement. When the eyes are drawn to one side, the cerebrum sends impulses to jerk the eyes back quickly to their original position. This quick component, however, has nothing to do with the ear impulse. Whether the slow movement is caused by the sight of external objects passing (when in an elevator or railroad train), or by ear stimulation, the quick recoil in both instances is purely the cerebral attempt to bring the eyes back to their normal position. The ear-pull is only the slow component of the nystagmus.

The purpose of this paper is not to deal with physiology for itself alone—the main reason for simplicity in this subject is that at the present hour there is practical need for the Barany tests. Probably the most important service that the Otologist can give to the Government—a service that is peculiarly his own—is in aviation. Perfect equilibration is accomplished through an harmonious cöoperation of the eye, the muscle-sense, and most particularly the "balance-sense" of the ear. The ear function is of peculiar importance in that the vestibular labyrinth has for its *sole* purpose the maintenance of balance. After impairment or loss of one of the senses responsible for equilibrium, compensation may take place to a certain extent—provided that the individual is on "terra firma." The tabetic may be taught to avail himself of the visual-sense and of the balance-sense of the ear in cöordinating his movements. Similarly, the blind man is able to walk by the aid of a cane until deprived of the guidance of either the muscle-sense or the balance-sense of the ear. Deaf mutes in whom the ear-sense is destroyed are enabled to maintain their balance by means of sight and the muscle-sense, and develop incoordination only in the dark or in the water.

However, when the human being becomes a bird, as it were, he suddenly finds himself in an entirely new environment. Without normally functionating ears it would probably be impossible for man to invade the realm of the bird. In flying through the air on what does the aviator rely in order to maintain his equilibrium and that of the aeroplane? Can he rely on his sight? Hardly, for when he is sailing

through the clouds or in the dark, his eyes positively cannot give him the slightest information as to his position in space, not even whether he is right side up or upside down. As regards the muscle-sense, it is undoubtedly true that it plays a certain part; but when the aviator is seated on an unstable and rapidly moving machine, it is hardly conceivable that the weight of his body could determine and maintain his position in space merely by the sense of gravity. In order, therefore, to preserve that wonderful accuracy necessary in operating such a delicate mechanism as the flying machine, it is obvious that he relies primarily upon his vestibular labyrinth. It is easily conceivable that some of the unexplained accidents in aviating may be due to the influence upon the internal ear produced either by the rush of the air or by the decrease of the usual air-pressure when at great heights. Since normal internal ears are such an important asset to the aviator, common prudence would suggest a most careful examination of the degree of function of one's internal ears, before taking up flying as an occupation. The ear-tests furnish an exact and mathematical analysis not only of the function of the internal ear, but also of the entire vestibular apparatus. When a candidate for the aviation service of the Government presents himself, it is to his own personal interest as well as for the good of the service, that every portion of his "balance apparatus" should be determined to be intact and normally functionating. This can be absolutely determined by the ear-tests,—"Yes" or "No". If, after the Barany tests, the candidate shows normal responses in nystagmus, past-pointing and falling, he is fit for this service. If he does *not,* he is unfit.

The following standard for entrance in the aviation corps of the U. S. Army has been approved and constitutes the requirements for admission into this service:—

EQUILIBRIUM—VESTIBULAR TESTS.

20. The nystagmus, past pointing and falling, after turning are tested. The turning chair must have a head rest which will hold the head 30° forward, a foot rest and a stop pedal.

(*a*) *Nystagmus.* Head 30° forward; turn candidate to the right, eyes closed, 10 times in exactly 20 seconds. The instant the chair is stopped, click the stop-watch; candidate opens his eyes and looks straight ahead at some distant point. There should occur a horizontal nystagmus to the left of 26 seconds' duration. Candidate then closes his eyes and is turned to the left; there should occur a horizontal nystagmus to the right, of 26 seconds' duration. The variation of 8 seconds is allowable.

(*b*) *Pointing.*

1. Candidate closes eyes, sitting in chair touching examiner's fingers, held in front of him, raises his arm to perpendicular position, lowers the arm and attempts to find the examiner's finger. First the right arm, then the left arm. The normal is always able to find the finger.

2. The pointing-test is again repeated after turning to the right, 10 turns in 10 seconds. During the last turn, the stop-pedal is released and as the chair comes into position, it becomes locked. The right arm is tested, then the left, then the right, then the left until he ceases to past-point. The normal will past-point to the right three times with each arm.

3. Repeat pointing-test after turning to the left.

(*c*) *Falling.* Candidate's head is inclined 90° forward. Turn to the right, 5 turns in 10 seconds. On stopping; candidate raises his head and should fall to right. This tests the vertical semicircular canals. Turn to the left, head forward 90°; on stopping, the candidate raises his head and should fall to the left.

Unless each test is normal, it is a cause for rejection.

Any candidate for service in any branch of the Army must conform to a physical standard. He must be a normal man, such as would satisfy the average insurance company, with the additional requirements of minimum height, weight, chest measurement, and auditory and visual acuity. The aviator must have not only these requirements, but must also have a normal balance-mechanism. Therefore, the determining test for the aviator is the Barany test.

From the practical standpoint of the Otologist conducting the test, there is only one thing he needs to consider—the direction of the endolymph movement. The objective phenomena are the eye-pull, the past-pointing and the falling. All occur in the direction of the endolymph movement.

Discussion.

Dr. J. Gordon Wilson, Chicago, thought a satisfactory age limit for aviators was 25 years. In selecting the men, while

it was essential to thoroughly examine the condition of the ears and eyes, and to insist that they be up to standard, yet it was well to remember that the physical examination and even inquiries into past illnesses should not be neglected. This might be illustrated by the case of an aviator who passed successfully all tests, yet when flying above 6,000 feet he had difficulty with vision and some vertigo. The basis of this was traced on investigation to a nephritis which he had had four or five years previous.

A discussion of Dr. Randall's paper raised so many unsettled physiological questions that a whole session might well be spent discussing them. The physiology of the semicircular canals was far from settled. Dr. Randall rightly refers to the labyrinth as kinetic. He thus brings us back to the seventies, when Goltz held that the labyrinth was static and Crum Brown that it was kinetic.

Major Lyster, of the United States Army Medical Corps, emphasized the importance of the work of otologists in the present war crisis, especially in connection with the selection of men for the Aviation Corps. The time had come when it was realized that supremacy in the air meant supremacy on land and water. Fortunately, the young men of the country were coming forward promptly for this service, the fit and the unfit. It had been found that from three to four months was sufficient for training a man for the air, and for making him effective in that work. For the present only those especially adapted for this service were being accepted. The man for the aviation service has to be selected with the idea that he is physically fit; the man next in line will teach him how to run the machine, but the medical man will have to determine whether he is physically fit or unfit. If not fit physically he must be thrown out. This country has time now to profit by the experiences of the other belligerent countries, and to eliminate the unfit. This is the work of trained otologists. The tests, however, should not be made so time-consuming as to cause the authorities to say the results do not warrant the time spent. Dr. Jones had shown that five

minutes were sufficient for determining accurately whether a man's vestibular activity was requisite. It was not necessary to have a standard at present other than one which would facilitate making a beginning. That was the reason for the adoption of the present standard, which would meet immediate requirements. It was reasonably safe and scientifically accurate.

The question of standardization has been approached, first from the point of view of the aviator, second from that of the examiner. The knowledge necessary for making the examinations must be dessiminated, in order that the same classes of examinations be made throughout the country. Naturally the examinations should be made by men trained to accurate observations, so that their findings could be depended upon. With this in view it had been decided to take the large centres, such as Philadelphia, New York, Chicago, and other large cities, in which to establish units. Men were to be selected as examiners who had been recommended by the otological or other societies, and they were to be placed in the Reserve Corps. The standards must be accurately carried out. The candidates were not to be passed for any special reason, or for lack of time; the examinations must be methodical.

Probably ten thousand aviators would be needed the first year. That would mean probably thirty thousand examinations. If there were a thousand examiners, that would mean perhaps thirty examinations a day. The plan of having centres in the large cities had been suggested by Dr. Wm. H. Haskin of New York and initiated at the University of Pennsylvania, where, thanks to the influence of Dr. Jones, Dr. Randall, Dr. Martin, and others, the resources of the University had been placed at Dr. Jones' disposal. In New York City, the Manhattan Eye and Ear Infirmary had been offered; in Boston, the Charitable Eye and Ear Infirmary; in other cities similar institutions had done practically the same. It was not, however, a matter of which institution became the centre; the question was one of patriotism and not of institutions. This support has come in a most

magnificent way so far, and the same cooperation is hoped for throughout the entire country. Scientific bodies, such as the American Otological Society, could render valuable assistance by helping in the selection of examiners, and by giving the Medical Department their support with both institutions and men.

Dr. W. H. Haskin, New York City, expressed the hope that the Society would give its unbounded support to Major Lyster and the Government in the execution of the proposed plan. It was no time for the discussion of the standard adopted, of whether the labyrinthine tests required twenty-six seconds, more or less, the wishes of the Government should be complied with without argument.

Dr. Geo. E. Shambaugh, Chicago, Ill., thought the tests outlined by Dr. Jones answered the requirements quite well and suggested that the Society go on record as approving of these tests.

He called attention to the fact that the three men who had charge of the ear work in the University of Chicago, University of Illinois and the Northwestern University were members of the American Otological Society and had expressed their desire to place the Otological departments of these universities at the service of the Government for the examination of the recruits for aviation.

Dr. Eugene R. Lewis, Dubuque, Ia., called attention to the point that the Government was not interested in diagnosis, but only in ascertaining whether a man was or was not normal. His abnormality did not concern the Government. If this idea were kept in view, otologists would be able to serve more capably and efficiently.

THE STATIC LABYRINTH IN SYPHILIS.

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Syphilis, excepting tuberculosis, is perhaps the most prevalent disease with which we as physicians have to deal. Its frequency is startling, its manifestations are legion and no organ or tissue, from intrauterine life to the grave is free from the liability of its attack. The discovery and demonstration of the *Spirochaeta pallida* and the Wassermann reaction in the blood and the cerebrospinal fluid have conclusively proven the syphilitic nature of many diseases which we have heretofore considered and studied as clinical entities; therefore, though we may retain certain names for the sake of classification, we must accept the fact, as one author stated it, "that these diseases are syphilitic, and *always* syphilitic."

We know that syphilis of the cerebrospinal system may simulate any disease of the brain and spinal cord substance, their vascular supply and their coverings, and it is only by the examination of the blood or the spinal fluid that we can definitely determine whether or not a central nervous system lesion is syphilitic in origin. A vast amount of laboratory work along this line has shown that brain syphilis is by no means always a late manifestation of the infection, and thereby, it has become possible to diagnose lues of the central nervous system long before the appearance of the classic objective signs that we are used to consider as pathognomonic, such as the Argyl Robertson pupils, the diminished as abolished tendon reflexes, areas of increased sensibility, etc.[1]

Such signs in fact belong to a later stage of the infection and indicate that an irreparable destruction of the parenchymatous cells has already taken place, whereas in the early

1. Wile and Stokes—Involvement of Nervous System During the Primary stage of Syphilis, Journal A. M. A. March 20, 1915; p. 979. Six cases of early syphilis with involvement of nervous system in four. Collins—Brain Syphilis, Journal A. M. A. July 10, 1915. P. 139, (Vol. LXV, No. 2.)

stage of an invasion it is vascular structures and the meninges which are involved, and though it does not necessarily follow that a basilar meningitis of syphilitic etiology must lead to an involvement of the brain or cord substance, there is always this possibility which undoubtedly may be the better averted the sooner appropriate treatment is instituted.

The subject of brain syphilis is of prime importance to the otologist for the reason that the preponderance of evidence in many investigations goes to show that the *eighth nerve* is more often affected in all stages of syphilis than any other of the cranial nerves; that the lesion is probably a true neuritis of the eighth, its nuclei, its trunk or its peripheral distributions; and that its involvement is indicative of the luetic invasion of the central nervous system.

For many years we have recognized that certain forms of deafness were due to hereditary syphilis. The first contribution to the subject was probably published by Feichtman (1) in 1857, though the classic paper of Hutchison and Jackson (2) may be considered the pioneer work, especially as these authors correctly defined the nerve deafness which is characteristic.[2]

It is not only in hereditary syphilis, however, that the auditory nervous mechanism may become involved. Habermann (3) in 1896 reported 66 cases of syphilis of the internal ear, of which 34 were attacked during the secondaries. Mayer (4) in 1911 reported 65 cases of syphilitic internal ear disease, 30 within the first year of the infection, 13 within from three to ten weeks following the primary sore. Politzer (5) reported one case occuring seven days after the chancre. All these cases, and many more by various authors, were reported before the advent of salvarsan to the use of which so many cases of deafness has been accredited. It is far from the purpose of this paper to reopen that controversy, for it is now pretty well understood that insufficient treatment with the arsenical preparation may do harm although the extent

2. C. Ernest West has given a complete historical review of the subject in his chapter "Aural Syphilis" in the monumental "System of Syphilis" edited by D'Arcy Power and J. K. Murphy.

of this has undoubtedly been exaggerated. In 1915 G. W. Willcut (6) presented, before the American Medical Association, a report of 293 syphilitics examined by him in Urbantschitch Clinic. None had had salvarsan. In 56 cases of a month's duration or less he found 52 showing the characteristic deafness of syphilis. All had negative Wassermann reactions but the diagnosis was certified by the demonstration of the *spirochaeta pallida* in the primary sore. G. P. Wintermute (7) reported three cases of acute syphilitic acoustic neuritis before the same session of the American Medical Association (San Francisco, 1915), and gave complete and valuable data concerning the symptoms, course and treatment of these conditions. The cases studied, both by Willcut and Wintermute, are most conclusive, and the bibliographies furnished by these authors are very complete.

Evidence is surely not lacking that the eighth nerve is often affected in primary syphilis, nor is proof wanting that it is also often involved in the late syphilides, and that aural symptoms may be one of the first signs in tabes dorsalis and general paresis. Ellis and Swift (8) found deafness of the nerve type in 40% of a series of tabetic cases. Shaller (9) found the internal ear involved in 16 cases out of 35 patients with early tabes. Deafness is now mentioned by all neurologists as one of the symptoms often found in the preataxic stage of tabes dorsalis.

Naturally there have been many different views respecting the portion of the ear, and of the nervous apparatus of the ear, that is affected in syphilis. Sexton (American Journal Medical Sciences, 1879) attempted to show that the deafness in syphilis was due to lesions in the middle ear, but this contention was completely refuted by St. John Roosa (Arch. of Otol., 1879). Moos in 1887 (10) found changes in the vestibule, in the organ of Corti and in the ampullae of semicircular canals but a normal nerve trunk in a patient with secondary syphilis who had died soon after ear symptoms had arisen, and thus the trend of opinion from then on was to consider the ear lesions of the secondaries as intralabyrinthine.

Deafness occurring in tertiary syphilis was studied by Rosenstein (11) who found lesions in the nerve stem, in the nuclei, in the roots, and in one case in the roots alone (Ellis and Swift (8)). Mannasse (12) has given a most complete picture of the morbid anatomy found in a patient with tertiary syphilis who had been deaf for one year before death. He found changes in the nervous structures of the cochlea, of the semicircular canals and also in the nerve trunk. In tabes with deafness Habermann (13) found gray atrophy of both auditory nerves and atrophy of the nerve endings in the cochlea and in the semicircular canals. The nuclei were intact, the lateral and median acoustic roots much atrophied. Bruehl (14) found degeneration in the nuclear region of the eighth. Mayer (15) studied five cases of general paresis with deafness and found atrophic changes in all the nervous elements of the ear from the organ of Corti to the medulla. Rosenstein (11) believes that deafness in inherited lues is due, in many instances, to a basal meningitis, though other observers place the lesion within the labyrinth. In 1912 Knick and Zaloziecki (16) examined the spinal-fluid in nine cases of early syphilis with deafness and found a high cell count in all nine, and a positive spinal fluid Wassermann in eight. They claimed, therefore, that the deafness in early syphilis is due to a syphilitic meningitis which involves the eighth nerve.

Ellis and Swift (8) corroborated this work in seven cases of their own and concluded: "that all lesions of the eighth nerve are possible manifestations of a disastrous form of a general infection—syphilis of the central nervous system." Willcut (6) believes that the involvement of the cranial nerves in early syphilis is due to a toxic irritation of the nerve sheath and the peripheral end organs. He mentions the eighth, the first and the seventh, and says: "The acoustic for some unexplained reason appears to be the most sensative of all the cranial nerves." Willcut and many authors seem to overlook the anatomical peculiarity of the eighth nerve being devoid of neurilemma; it is, therefore, all the more liable on account of its position to become inflammed during the

course of a basal meningitis or from toxic substances circulating in the cerebrospinal fluid. It is hardly possible to doubt the observations of any of the authors quoted, consequently though we accept the conclusions that the lesion is to be found in the nerve tissue, we must also accept the fact that the eighth nerve may be attacked centrally, axially or peripherally; therefore, the careful clinical study of this particular class of patients by the newer and more accurate methods of otologic examination should put us well on the way to that precision in diagnosis which Robert Bing says is wanting, namely, the differentiation between lesions of nerve or its supra-nuclear tracts and lesions of the percipient structures in the internal ear. It is possible to separately examine both the cochlea branch and the vestibular branch of the eighth, and in the latter tests the phenomenal work of Bárány has been so amplified by the methods and teachings of Randall, Jones, Fisher, Brumm and others of the "Philadelphia School," that localization of eighth nerve lesions has certainly passed beyond the stage of hypothesis.

It is generally taught that if the cochlea division of the eighth is found to be normal, the so-called static labyrinth and the vestibular nerve will also be normal. In syphilis, however, it is possible for the vestibular branch to become involved at some point along its course, while the cochlea branch may remain normal. That the reverse may be true is admitted by all. In a large percentage of syphilitic cases both divisions of the eighth will be affected and, therefore, both the auditory and the static labyrinth should be tested. Patients with the acoustic neuritis of syphilis may hear the voice surprisingly well and may not complain of deafness until questioned; the tuning forks, therefore, offer the best means of correct diagnosis in these cases.

The typical hearing defect is a shortening of the duration of perception by bone-conduction, out of all proportion to the shortening of the duration of perception for the same fork by air-conduction, the retention of good hearing for the low forks, with a loss of perception, or a reduction in duration of perception, for sounds of high pitch. All tuning

fork tests should be made under the correct law of decrement of vibrations (Dundas Grant 17), therefore, we should attempt to determine the shortening in the duration of perception as compared to the normal, and not simply the duration of perception itself.

The Schwabach test is best made with the opposite ear excluded by a "noise-apparatus" regulated to that intensity which is just sufficient to prevent contra-audition. If the Rinné is made by separate tests of bone and air-conduction it is not infrequent to find that bone-conduction is actually reduced out of all proportion to the reduction of perception by air-conduction, as physically impossible as this may seem, and such a reaction is indicative of an acoustic neuritis rather than of an intralabyrinthine lesion. I have found the C5 (4096 d. v. s.) fork of more use in routine work than the Galton whistle, for the reason that the intensity is so great with the latter instrument that partial defects in the high register are difficult to determine.

No matter with what care we may attempt to determine reductions in audition, we must always depend upon purely subjective methods. The tests of the vestibular apparatus are to a large degree objective, and in normal individuals the reactions are surprisingly constant, when the tests are made with precision and with due regard to details. In the rotary tests the after-nystagmus should last for 26 seconds, the patient having been turned ten times in twenty seconds. The vertigo should last under the same conditions for 24 seconds. Nystagmus should be induced in 40 seconds by douching the ear with water at 68° F. These are the normal responses found by I. H. Jones, who has further simplified the interpretation of the reactions by giving us the very easy rule to remember, that the nystagmus, the falling and the pastpointing are all in the direction of the endolymphic flow, with the vertigo in the opposite direction. Dr. Jones, and his associates further teach that each semicircular canal has a separate nystagmic and vertigenous tract of its own. They have been able to locate, and to postulate, the probable situation of some of these pathways in the brain-

stem, the cerebellum and the cerebrum, hence their methods of localization in the eighth nerve, lesions, and in intracranial conditions involving the eighth nerve, are the most logical that we have.

In the last eighteen months I have had the opportunity of making an ear examination of a creditable number of patients with syphilis and syphilitic central nervous system lesions. A number of cases have been examined in the Neurologic Clinic of the Mercy Hospital, and I am greatly indebted to the Neurologist-in-Charge, Dr. A. C. Gillis, for his co-operation. Many of these patients did not complain of ear symptoms though it was not difficult to demonstrate an associated aural involvement. A number presented predominant internal ear disturbances, and in a few instances the examination of the ear led to the diagnosis of serious diseases of the central nervous system. Though the auditory function was disturbed in most of the cases, the tests of the static apparatus, made by rotation and cold douching, were of far greater value in absolutely confirming the presence of a lesion in the nervous structures of the ear than were the tests of audition.

Generally speaking the abnormal response of the static labyrinth in syphilis may indicate a lesion of the vestibular nerve at any point from its nuclei to its peripheral distributions. If we may have "islands of deafness," we likewise may have *islands of static inhibition;* should these defects be situated neuraxially, the reactions from the vestibular tests may simulate those seen in brain-stem, cerebellar or cerebello-pontine tumors. As a rule, however, the syphilitic responses indicate involvement of the eighth nerve trunk or its peripheral distributions. The neuraxial symptoms are likely to be so atypical that they indicate lesion of such widely separated areas that simultaneous involvement of these tracts by a new growth would be impossible, whereas a degeneration of these different pathways is not at all improbable. The most characteristic reaction of syphilitic internal ear disease is a lowering and confusion of all the

responses; this may vary from the totally dead labyrinth giving no responses, to the cases showing all the normal reactions reduced in degree. For example, the mystagmus will last but 10 to 15 seconds or less, and will show fine oscillations in which the slow and quick components cannot be easily differentiated. Vertigo is absent, or it lasts but a few seconds. Falling is not definite. The patient, if tested quickly after rotation, will pastpoint with one arm and not with the other, or will only pastpoint for a few inches, or will pastpoint incorrectly. The responses may be intensified by increasing the stimulation; thus, nystagmus may be absent after ten turns in twenty seconds to become evident for some seconds after ten turns in ten seconds. Douching with water at 68°F. will bring on the same reduced or confusing reactions after a much longer period than the normal 40 seconds, or it may require much colder water to bring out any response. Furthermore, it is apparently possible in these cases for one semicircular canal of the same ear to be more affected than the others; hence, we may get normal responses from rotation with the head in the upright position (horizontal canals), and abnormal reactions with the head forward (vertical canals), or *vice versa*. Such a lesion would have to exist in the crista-ampullaris of one canal only, or as a partial degeneration in the nerve trunk itself before the nystagmic and vertigenous tracts separate.

Increased irritability of the static labyrinth, evidenced by prolonged nystagmus, with marked vertigo and nausea, is a sign which may not be overlooked. Crossed pastpointing, right arm to the left and left arm to the right after turning to the right, and *vice versa*, has been noted, as has complete reversal of the pastpointing, both arms to the left after turning to the right, and both arms to right after left turning. Variations from time to time in all the responses must be expected and may be of value in following the improvement or the retrogression of the syphilitic process. The reactions in most instances point to the ear which is most involved, and one ear is usually involved to a greater degree than the other, though as a rule both are implicated.

I have included in this study 28 patients in whom the diagnosis of syphilis has been positively established, and though the number is far too small to be of statistic value, the clinical data obtained has indicated the general signs just enumerated. Certain groupings of these cases, and individual histories, are not without interest. The histories are arranged in two series: first, those patients in whom ear disturbances were the complaints for which the patient sought relief; secondly, those patients with central nervous system diseases upon whom a routine ear examination was made irrespective of aural symptoms. For the sake of brevity a synopsis of the salient features are given and details are reported in full only when they have seemed essential.

There are 12 patients in the first group who came complaining of deafness, tinnitus and vertigo, the frequency of the complaints being in the order named. Deafness and tinnitus were usually both present, but vertigo was not voluntarily mentioned, though histories of slight attacks were elicited in five cases. A shortening of ten seconds or more in the duration of perception by bone conduction for the C2 (512 d. v. s.) tuning fork was the basis for further examination of the internal ear, and in every patient under discussion both the cochlea and the vestibular functions were found to be impaired. Five of these patients were the victims of hereditary syphilis, four of whom had had interstitial keratitis. These five cases show practically all the variations of syphilitic eighth nerve involvement.

Case 1: Marie P. Col. Age 9 years. Admitted Dec. 6th, 1916. Hereditary syphilis. Interstitial keratitis in active stage. Positive blood Wassermann. Sudden and practically complete nerve deafness of both ears, of three weeks' duration. Both static labyrinths without response in any particular or from any test. No improvement under vigorous mercurial treatment. When the patient was first seen there was a slight amount of hearing present; this has now been destroyed. The child enjoys being literally whirled in the chair with the head in any position and can immediately stand erect without a tremor.

Case 2: Sydney W., White. Age 17 years. Hereditary syphilis. Incomplete nerve deafness of three years' duration. Positive blood Wassermann. Static labyrinths markedly affected on both sides, though right ear is the deafer of the two.

Right turning (head upright): Nystagmus for 10″ Vertigo for 25″. Pastpointing negative in both arms.

Left turning (head upright): Nystagmus negative. Vertigo for 10″. Pastpointing of right arm negative. Left arm to right a few inches.

Both ears negative to cold douching, in all positions.

Case 3: Edith L. White. Age 16. Hereditary syphilis. Incomplete nerve deafness of the luetic type more marked in right ear. Static labyrinths involved. Blood Wassermann positive.

Right turning (head upright): Nystagmus for 25″. Vertigo present, but patient complained more of nausea. Pastpointed with right arm correctly to right. Left arm negative.

Left turning (head upright): Nystagmus for 15″. Vertigo slight. Both arms failed to pastpoint.

With the cold caloric nystagmus could be induced from both the horizontal and the vertical canals of both ears. Nausea more marked than vertigo. Pastpointing all negative except that left ear stimulation of both the horizontal and the vertical canals caused the left arm to pastpoint correctly.

Case 4: Mary B. White. Age 17 years. Admitted July 11, 1916, complaining of deafness of eighteen months' duration, more marked in right ear. Hearing tests showed incomplete nerve deafness of luetic type.

Right turning (head upright): Nystagmus for 8″. Vertigo negative. Pastpointing with right and left arm three inches to right.

Left turning (head upright): Nystagmus for 3″. Vertigo negative. Pastpointing with right arm negative, with left arm three inches to right.

The girl has a brother totally deaf from measles [?]. Her

teeth are Hutchinson in type. Her blood Wassermann was positive.

Case 5: John M. White. Age 10 years. Interstitial keratitis in subacute stage. Deafness complained of. Impossible to make satisfactory hearing tests. Right turning gave nystagmus for 15″. Left turning did not arouse nystagmus. Blood Wassermann positive. Although the tests are incomplete in this case, there is sufficient evidence to show that the cochlea and the static functions are both disturbed.

In cases 2, 3, 4 and 5, the hearing is not markedly impaired. All these people can hear the conversational voice without much difficulty. The vestibular tests have been of far more value in correctly determining the nervous character of the aural disturbances than have been the tests of the audition.

The other seven patients in this group were patients with acquired lues from whom it was impossible to obtain a history of the primary lesion, except in two instances, the value of the ear tests in this particular may be demonstrated by the citation of one case.

Case 6: Katherine H. White. Age 17. Admitted Aug. 1st, 1916, complaining of deafness of the right ear which had started July 6th. The hearing tests were very uncertain, but the duration of perception by bone conduction for the C2 fork seemed shortened about 13″ in the right ear, and 10″ in the left.

Right turning (head upright): Nystagmus for 22″. Vertigo very slight. Right arm pastpointed to left. Left arm did not pastpoint.

Left turning (head upright): Nystagmus for 7″. Vertigo negative. Right arm did not pastpoint. Left arm pastpointed to right.

The caloric tests, and turning with the head in various positions gave confusing, conflicting and abnormal responses. No history could be obtained from the patient. Her blood Wassermann, however, was positive; and her hearing rapidly improved under antisyphilitic treatment.

The next two cases are of interest from the valuable indication given by the ear examination of serious central nervous system involvement.

Case 7: Deafness. Optic atrophy. Argyl Robertson pupils. Negative blood Wassermann. Positive spinal fluid Wassermann. Tabes dorsalis.

Louis S. White. Age 44. Admitted June 12th, 1916, complaining of deafness more marked in the left ear. The duration of perception by bone conduction for the C2 fork was 25″, duration of perception by air conduction 15″. The duration of perception by air conduction for the C fork was 10″, for the C5 fork 5″. The right ear showed a slight reduction in the bone conduction. The patient said that his eyes were also bad, and ophthalmoscopic examination disclosed a beginning primary optic atrophy, more marked in the left eye. Vision R. 18/20. L. 18/49. Pupils unequal, irregular and sluggish to light. Patella reflexes absent. The man admitted a primary lesion occurring twenty-five years ago.

Right turning (head upright): Nystagmus for 25″. Vertigo and nausea. Right arm did not pastpoint. Left arm pastpointed to right.

Left turning (head upright): Nystagmus for 25″. Vertigo and nausea. Right arm did not pastpoint. Left arm pastpointed to right.

The diagnosis of tabes was simple enough in this case and, of course, was not dependent upon the ear examination. After intravenous and intraspinous treatment with neo-salvarsan, the eye condition improved slightly, and the responses of the static labyrinth became perfectly normal. We were only able to follow this case for six months when he disappeared from the clinic and so far we have not been able to locate him.

Case 8: Nerve deafness. Marked increase in the duration of the after nystagmus with nausea and vomiting. Negative blood Wassermann. Strongly positive spinal fluid Wassermann. Tabes dorsalis.

Ella R. Col. Age 38. Admitted July, 1916, complaining of

deafness of the right ear of four years' duration, of the left ear of a few months' duration. The bone conduction of the right ear for the C2 fork was negative, the air conduction 25″. The C fork was shortened 20″ in duration of perception, the C5 could not be heard. The left ear showed bone conduction, (C2 fork,)—20″, air conduction for the same fork—13″. The C was but slightly shortened, the C5 was normally heard.

Right turning (head upright):—Nystagmus for 50″. Vertigo, nausea and vomiting. Pastpointing normally to right with both arms.

Left turning (head upright):—Nystagmus for 45″. All other responses normal but exaggerated.

The cold caloric brought on the same severe reactions from both ears in all positions of the head.

The blood Wassermann was negative. The woman was put on mercury for a week and at the end of that time the Wassermann was again negative. The woman drifted away from the clinic to return in January 1917 complaining that her hearing was worse and that she had headache and "stomach pain." Her pupils were small and sluggish to light and she was strongly urged to have a spinal puncture but refused. On May 10, 1917, she consented to the examination and the spinal fluid examination was as follows: Cell count 31 per cmm. Wassermann strongly positive. Ross Jones and Pandy positive. Diagnosis: Tabes dorsalis.

The four remaining cases in this group are not without interest but they will have to be dismissed with mention only. All had an acoustic neuritis of syphilitic origin with involvement of the static functions.

From the work done at the Mercy Hospital I have selected 16 cases for study which may be grouped under the heads of the neurologic diagnosis of cerebral syphilis, tabes dorsalis and general paresis.

Seven of these patients may be classified as cases of early brain lesions, six of whom came to the hospital with the complaint of severe attacks of vertigo and the examination of the ear showed the static labyrinth to be definitely involved in

five out of six. The patient who did not complain of vertigo had had an involvement of the 9th, 10th, and 12th, cranial nerves. His static labyrinths were apparently normal, the tests, however, were not as complete as I should like them to have been, but he did show a definite "island of tone deafness," for the C3, C4 and the C5 fork, although he heard the upper range of the Galton whistle.

One patient was seen the day following a severe attack of vertigo. Certain details of her history are of interest.

Case 9: Annie M., Col. Age 29 years. Admitted March 1st, 1917, complaining of severe headache and vertigo. The night before she had fallen and had to be carried to bed. She gave a definite history of lues, the primary lesion having occured in 1910. Examination showed a positive Romberg. Tenderness on palpation over skull. Neurologic diagnosis: syphilitic meningitis. Her ear-drums were normal, her hearing tests showed a reduction in the perception by bone conduction of 20″ in both ears. All other tuning fork tests apparently normal.

Right turning (head upright):—Nystagmus for 23″. Vertigo for 15″, Pastpointing negative with both arms.

Left turning (head upright):—Nystagmus for 21″. Vertigo uncertain. Pastpointing negative both arms.

Two days later, right turning gave nystagmus for 21″. Left turning nystagmus for 12″. One week later (March 28th, 1917), with the patient much improved generally, right turning nystagmus 22″, left turning nystagmus 15″. The patient felt so much better that she did not return to the clinic and could not be located. It would seem, from this case, that the vestibular tests offer a most accurate means of following a process of this kind.

I can only touch upon the findings in the other patients of this group, as anything less than complete histories would be of little value. The presence of a positive Romberg in these patients is suggestive of the aural nature of this sign.

Case 10: Wm. G. M. White. Age 25 years. Admitted July 27th, 1916. Complaining of severe vertigo of three weeks'

duration. Romberg positive. Neurologic symptoms pointing to a cerebellar tumor. Spontaneous vertical nystagmus on looking up. Hearing normal. Vestibular tests indicative of a neuraxial lesion, but exceedingly variable and changing from day to day. The patient denied lues and his blood was negative to the Wassermann test on two occasions. The spinal fluid showed, cell count 42, Wassermann inconclusive, globulin tests strongly positive. On August 30th, 1916, the patient became suddenly and completely deaf in the right ear. He died September 15, 1916, and the postmortem examination showed an old syphilitic meningitis with a degenerated gumma in the middle lobe of the cerebellum extending to both lateral lobes particularly of the right side and involving the region of Deiter's nucleus.

Case 11: Chas. L. White. Age 47. Admitted August 1916, complaining of sudden and complete deafness of both ears and of severe vertigo of ten days' duration. Romberg positive. Neurologic symptoms indicative of a lesion in the region of the corpora quadrigemina. Spontaneous nystagmus to right. Blood and spinal fluid showed strongly marked positive Wassermann. The man left the hospital, but died in a few weeks. Vestibular tests indicative of a neuraxial lesion though the responses were uncertain and not of great localizing value. No postmortem obtained.

Case 12: M. M. White, Age 35 years. Admitted July 6th, 1916, complaining of vertigo and deafness. Typical acoustic neuritic defect in hearing. Nystagmus endured for 45″ and 35″ with the head upright, and vertigo and pastpointing were normal. With the head forward, right turning elicited neither nystagmus, vertigo nor pastpointing. On left turning the reactions came through normally. Positive blood Wassermann.

Case 13: Louis M. White. Age 42. Admitted November 10th, 1916, complaining of vertigo, deafness and tinnitus. Romberg positive. Vestibular tests showed reduced nystagmus from both ears, and no vertigo or pastpointing. Hearing defect of luetic type. Primary lesion in 1913. Positive Wassermann.

Seven cases of tabes dorsalis in various stages have been studied. In four of these the cochlea and the vestibular branch of the eighth were involved. The cochlea branch alone in one, the vestibular branch alone in two. These patients were not markedly deaf, indeed a history of hardness of hearing could only be obtained in three of the cases. Four of these patients had primary optic atrophy. Generally speaking the aural defects were not of wide extent but they were none the less striking.

Case 14: Ethel W. Col. Age 35, with tabes and optic atrophy, showed normal nystagmus in both directions but on right turning, the right arm pastpointed correctly to the right, but the left arm pastpointed to the left. On left turning, she pastpointed with the right arm to the right and with the left arm to the left. This pastpointing error was present in all positions of the head.

Case 15: Harry T. White. Age 36, with tabes and optic atrophy showed nystagmus lasting for twenty seconds in both directions, but on right turning he pastpointed with the right arm to the right and with the left arm to the left. On left turning the pastpointing of both arms was correctly to the left. The error of the left arm on right turning was present in all positions of the head.

Case 16: Columbus A. Col. Age 50, has been under observation by Dr. Gillis for several years. He presents a cerebellar type of tabes dorsalis with a positive Romberg. His hearing is normal. He has a spontaneous nystagmus, vertical in type, on looking up, and he shows but one abnormal vestibular response, viz: a failure in pastpointing corresponding to a brain stem lesion.

One case of general paresis showed complete reversal of pastpointing.

Case 17: Minnie S. White. Age 38. Neurologic diagnosis: General paresis. Positive Wassermann in spinal fluid. Hearing normal. Romberg, suggestive.

Right turning (head upright):—Nystagmus very fine in type, apparently lasting for 20″. Both right and left arms pastpoint to the left.

Left turning (head upright):—Nystagmus the same as in right turning. Both arms pastpoint to the right.

The error in pastpointing is present in all positions of the head.

Finally I must beg indulgence for a work of such magnitude from which as yet I feel incapable of drawing any but the most general conclusions. Syphilis as a cause of internal ear diseases is a factor which may never be considered lightly, and as the static mechanism as well as the auditory apparatus is often involved, we as otologists, have in the vestibular tests a means by which an early perversion of eighth nerve function may be detected. There is probably no pathognomonic vestibular response in syphilis, but the very confusing and complicating reactions are in themselves indicative of multiple lesions, a characteristic of any syphilitic invasion. If syphilitic neuritis of the eighth always points to an involvement of the central nervous system, then in all justice to the patients, they should command the combined knowledge of the otologist, the neurologist and the syphilographer, for Ellis and Swift (8) have shown that the prognosis need not be so grave if treatment is instituted in time.

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Discussion.

Dr. Geo. E. Shambaugh, Chicago, said that an interesting feature of the syphilitic involvement of the internal ear was the fact that this process may involve the vestibular apparatus and progress to the point of complete suppression of function without at any time evoking the symptom of vertigo. The detection of the destruction of function in the semicircular canals is made only after testing by rotation and caloric stimulation. He has seen cases where the complete destruction of the labyrinth function took place within a few months' time, in which there was an absence of vertigo. It would seem that if the destruction of function goes on simultaneously in both ears equally the balance may at no time be disturbed.

Dr. B. Alexander Randall, Philadelphia, had seen quite marked involvement of the labyrinth in less than forty days after the initial lesion of the disease. He cited the case of a physician with a primary chancre on his finger who had nerve-deafness, without any vestibular symptoms. He wished to call attention to the value of the old Donovan solution in early cases, when it was dangerous to use salvarsan. The symptoms could often be promptly mitigated, without injury to the optic or acoustic nerve.

Dr. Downey, in closing the discussion, said that the routine ear examination made in the neurologic clinic had been most valuable in his work. As Dr. Shambaugh had said, these patients do not always complain of vertigo, for example, the first case he had reported had gone on to complete deafness and complete loss of vestibular function within three weeks without a complaint of vertigo.

LANTERN SLIDE DEMONSTRATION OF PREPARATIONS SHOWING THE DEVELOPMENT OF THE MEMBRANOUS LABYRINTH.

By GEORGE E. SHAMBAUGH, M. D., Chicago, Ill.

The fundamental facts regarding the development of the membranous labyrinth have long been worked out. The preparations here demonstrated bring out nothing new in regard to these facts. The preparations are unusually perfect ones, owing to a new technic used in making them. The labyrinth of the pig when it is once ossified is readily shelled out from its location in the temporal bone quite free from surrounding osseous structures. A preparation of this sort lends itself admirably to sectioning, especially since it is possible to plan the sectioning so as to demonstrate to best advantage this or that part. Before the capsule of the labyrinth has become ossified the cartilaginous labyrinth can be worked out in the same manner. The younger the embryo and the smaller and more delicate the labyrinth the greater difficulty one encounters in securing the separation of the labyrinth from the surrounding structures.

I have been able by this method, however, to separate successfully the labyrinth from pig embryos measuring 3.5 cm. The entire embryo is placed in fixing fluid and then hardened in alcohol. The head is then severed and with a delicate scissors the brain cavity is opened from above and the contents washed out. The location of the labyrinth can easily be recognized in the floor of the brain cavity. With delicate dissecting forceps the tissue is gradually picked away, care being taken at no time to seize the labyrinth itself with the forceps. This tiny specimen is then embedded in celloidin and can be sectioned as accurately through a definite plane as the larger specimen. The sections were all made by cutting directly through the centre of the modiolus, through the

vestibule, oval window, and the semicircular canals. The preparations were all cut five microns thick.

In the youngest preparation, that of a pig 3.5 cm., the stapes is still a part of the cartilaginous capsule and has scarcely begun to be differentiated from this structure. There are no evidences of perilymphatic spaces. The membranous semicircular canals are surrounded by cartilage. In addition to the embryonic ductus cochlearis, the membranous semicircular canals and the utricle and saccule, the preparation shows the stapes and beside it the facial nerve. The internal carotid is also shown lying close to the apex of the cochlea.

The next preparation is from a pig embryo 6 cm. long. Here the cartilage forming the stapes has become fairly well separated from the cartilage forming the capsule of the labyrinth. The membranous semicircular canals are separated from the cartilaginous capsule by an area occupied by connective tissue. In the vestibule the macula acustica and the utricle and saccule are distinctly indicated by a thickening of the epithelium. Absorption of the connective tissue surrounding the utricle and saccule has already begun. In the cochlea the embryonic tube forming the ductus cochlearis alone is found. There is no absorption of the connective tissue around the ductus cochlearis, which later takes place to form the scala vestibuli and scala tympani. The beginnings of the organ of Corti can be recognized by the epithelial thickening. A slight film over this region shows the earliest beginnings of the membrana tectoria.

The third section is from an embryo pig 8 cm. long. The formation of the perilymphatic chamber in the vestibule is well advanced and the process has already begun in the cochlea but is shown only in the basal coil. Both the scala vestibuli and the scala tympani are partially formed. The membrana tectoria is seen in the ductus cochlearis even to the apex of the cochlea.

The fourth section is through the cochlea of a 15 cm. pig. The scala vestibuli and the scala tympani are formed in the basal coil and part of the second. In the remainder of the

cochlea there is already a beginning of the scala tympani, but the scala vestibuli has not begun to form. In the formation of the perilymphatic spaces in the labyrinth the disappearance of the connective tissue seems to be one of absorption. I can find no evidences in my preparations of the pushing aside of the connective tissue stroma with the piling up of the nuclei along the margins as suggested by Dr. Streeter in his demonstration before this Society last spring. One gets from delicate preparations such as these which I am demonstrating, which are all made five microns thick and in which there is not the slightest distortion, the best opportunity for studying the minutest histological structures and changes.

The last section which I demonstrate is from a six day old pig. The section is directly through the middle of the modiolus and shows a perfectly formed organ of Corti throughout the cochlea. The excellent fixation in this preparation was accomplished by injecting the fixing fluid through the blood vessels previous to removing the cochlea.

PRESENTATION OF THE ORIGINAL EWALD EXPERIMENT IN THE LIVING.

By ISAAC H. JONES, M. D., Philadelphia, Pa.

Dr. Isaac H. Jones, Philadelphia, stated that by the greatest good fortune he chanced upon this unique case, which, so far as he knew, was the first demonstration in the living human being of the experiment which Ewald originally performed on pigeons.

The "Fistula Test" is considered positive if nystagmus is caused by pressure or suction produced by a rubber bulb applied to the external auditory canal. The production of a nystagmus, however, merely proves that there is present an opening into the labyrinth at some point. The essential value of the original Ewald experiment was that an artificial plug was inserted into a semicircular canal and then a hole was drilled at a point adjacent to this plug. In this way Ewald was enabled to produce an endolymph current in one direction only. This patient, Mr. John Brooks, has not only an opening into his horizontal semicircular canal, located at the point where the canal bends outward to produce the *aditus ad antrum*, but he also has a *closure of the canal* at a point behind the fistulous opening. This is demonstrated, in that pressure by the Politzer bag produces not only a nystagmus, but a *systematized vertigo*. This systematized vertigo is not merely made probable by the intelligent statement of the patient himself that he *feels* he is rotating exclusively to the right, at a speed of forty miles an hour, but is also definitely proven, in that, because of the vertigo, he *past-points* to the left, invariably, with all extremities.

Mr. Brooks, when asked to tell his own story to the Society, said:

"I am fifty years old. As far back as I can remember, I have had a running ear. My parents told me that it originally

came from an attack of scarlet fever, when a child. This discharge was not constant. It would appear occasionally during my life and would last only for three or four months and then disappear for a period of four or five years, at which time it would begin to discharge again. In fact, I can remember only about five times in which there was an actual discharge from my right ear. In June, 1916, the ear again began to have this discharge, the only difference being that a little, white kernel came out. This looked like a little mass of maggots without life. I merely noticed this little mass, but I suffered no inconvenience, and thus matters stood until the beginning of August. I then felt a slight irritation in the outer part of my right ear. I placed my finger on the outside and rubbed gently to alleviate this irritation. To my intense surprise, the whole room—everything in sight, in fact—revolved rapidly from left to right, and as quickly back again. Thinking that this was only a delusion, I tried this "push-button method" several times, and not once did it fail to register what I have just stated. I am a railroad conductor, and I have tried this same experiment while on the train. While standing on the rear platform of one of our cars, I rubbed my ear, and the entire train seemed to leave the track, swing over to the right, and swing back again quickly. This swinging of the train, first to the right and then back again, seemed to occur with my own self acting as the axis of the turning. Very foolishly, however, I paid no more attention to this matter, merely making it a point to keep my finger away from my ear, hoping that this queer condition might gradually disappear. A few mornings after, however, I was lying in bed on my back, and, as I rolled over on my right side, it seemed that some giant had lifted the left side of the bed to turn it over to the right, on top of me. I made a grab for the bedcovers. By this time I had stopped turning over to the right, and the elevating of the bed stopped at the same time. I must confess that I now began to be a little bit scared, as I could not understand why these things should be. Several days later,

while on duty. I was addressed by a passenger, and turned quickly to the right to answer his question, when, to my surprise, I found myself falling against the seats on the left side. This unsettled condition became more and more intense each day following, until it got so bad that I could not even shake my head from side to side, in saying 'no' in conversation, without having this 'falling feeling' come over me. I now became thoroughly frightened, as I thought these symptoms must surely be the forewarning of paralysis. I, therefore, consulted our family physician, Dr. Victor Janvier, who told me that evidently there was something seriously the matter with my ear."

Examination. Pressure by Politzer bag applied to right ear caused a pure horizontal nystagmus to the right, and a systematized vertigo also exclusively to the right. This showed an endolymph movement exclusively to the left. The eyes were drawn to the left in the direction of the endolymph movement, and the quick, cerebral jerk to the right produced the nystagmus to the right. As the vertigo is always in a direction opposite to the endolymph movement, this endolymph movement exclusively to the left produced a systemized vertigo exclusively to the right. Because of this systemized vertigo, all the extremities past-pointed to the left during the time that the pressure was applied to the ear.

Dr. Jones then applied the Politzer bag to the patient's right ear and demonstrated the past-pointing to the left when pressure was applied.

Moving pictures were then shown, showing the past-pointing of the right upper extremity, the left upper extremity, the right lower extremity, the left lower extremity, and the right elbow. All parts of the body were shown to past-point to the left on the instant that gentle pressure was applied to the right ear. The slow and the quick components of the nystagmus were analyzed by the moving pictures. The great question was to determine which was the slow component, and this was demonstrated by cranking the moving picture machine very slowly and observing that the *first* movement of

the eyes was to the left, and that, therefore, this movement to the left was necessarily the true slow component produced by the ear-stimulation.

Discussion.

Dr. Norval H. Pierce, Chicago, thought the case an interesting illustration of the tendency of labyrinthitis to recover. The recognition of this tendency, which should always be borne in mind, had done more than anything else to break down, at least in this country, the radical opinion held by the German school. A few years ago, when interest in labryinthine trouble was at its height, he had reported before this Society a case of a labyrinthine disease, and had stated his belief that the fatal issue was immediately hastened by the repeated demonstration of the fistula. He was very enthusiastic at the time, and had used this patient in demonstrating the caloric and fistula tests. After one of these rather strenuous afternoons, symptoms of meningitis began, and the man died three days later. He was convinced that in certain cases the clinical or experimental production of vestibular symptoms was not without danger for the patient.

Dr. Jones, in closing the discussion, said that the important matter was to cure the patient, and that the scientific phase of the case, although helpful, was, of course, secondary. It would, however, seem to be necessary to perform the Fistula Test, from time to time, in order to determine the progress of the healing process, which was evidently going on under local treatment. It is evident that the fistulous opening is gradually closing up and that a permanent closure might be possible without any operative procedure. In the opinion of most of the otologists who have examined this patient, it would seem inadvisable to consider operation, under any circumstances, unless the patient had a return of vertigo, or other evidence of further labyrinth involvement.

THE RESULTS OF BLOOD TRANSFUSION DIRECT AND INDIRECT, IN CASES OF POST-OPERATIVE SEPSIS, WITH NEGATIVE BLOOD CULTURES.

By JAMES F. McKERNON, M. D., New York, N. Y.

The basis of this report is due to the observations made in five cases of post-operative mastoids, four double, one single. All when operated upon were found extensively diseased, and all exhibited wide excursions of temperature as a post-operative feature, practically identical with typical cases of sigmoid and bulb phlebitis. In all the cases blood cultures were made from one to three times, with negative results. Differential and leucocyte counts were taken at frequent intervals,—the results being briefly shown in the histories of the respective cases. All extraneous diseases were ruled out by process of elimination. All of the cases exhibited a low recuperative power, with absence of anything like a normal resistance, and it was on this account that a blood transfusion was decided upon, hoping thereby to increase their resistance. The results obtained were so gratifying, both as to a lowering of the temperature and the rapid general improvement that followed, as to furnish my reason for bringing this subject before you for consideration, believing as I do that in this method of blood transfusion, we have at our command for the rapid cure of these septic cases, a most valuable therapeutic agent.

Case No. 1. Boy, six years of age; double mastoid. Duration of aural suppuration three weeks; probable duration of mastoid infection, six to eight days. Predominating microorganism was streptococcus mucosus capsulatus. Differential and leucocyte count made two hours prior to operation gave the number of white cells as 22,800, and the polynuclear percent as 84.2. The patient was vomiting at intervals, and presented all the evidences of profound sepsis. Below is the

temperature chart from the date of admission to the date of his discharge, on which is recorded the blood examinations together with the pulse rate and respirations. On the sixth day after operation a blood transfusion from vein to vein was done. Ninety c.c. of blood was given, the donor being the father of the child. The result of this transfusion was remarkable. The child, from being exceedingly restless and at times nauseated prior to transfusion, dropped off into a quiet, restful sleep of nearly six hours. Both color and pulse were better, and he showed a marked general improvement in every way. Three days later 60 c.c. of blood was given in a similar manner, and from this time on there was a still greater physical improvement. For the first six days following the operation there was no reparative process as far as the eye could discover, in either mastoid wound. Two days after the first transfusion the wound cavities began to show evidences of life and repair, and four days after the second transfusion of blood there was a rapid reparative process well under way, which continued uninterruptedly until complete healing had taken place, which was six weeks and four days from the time of operation.

Case No. 2. Girl 4½ years of age. Double mastoid. Duration of aural suppuration 18 days. Probable duration of mastoid infection ten days. Predominating microorganism streptococcus haemolitica. Differential and leucocyte count four hours before operation gave the number of white cells as 26,400; polynuclear percentage 88.6. Below is the temperature chart from the date of admission to the Hospital until her discharge, three weeks and four days later.

Twelve hours after operation the temperature rose abruptly, and there were wide excursions for ten days following. During this period two blood cultures were taken and several differential and leucocyte counts, the results of which were recorded on the chart. During this interval the little patient lost ground daily, and there was no reparative process in either wound, both mastoid cavities presenting nothing but bare bone, with the gauze packing practically dry at each

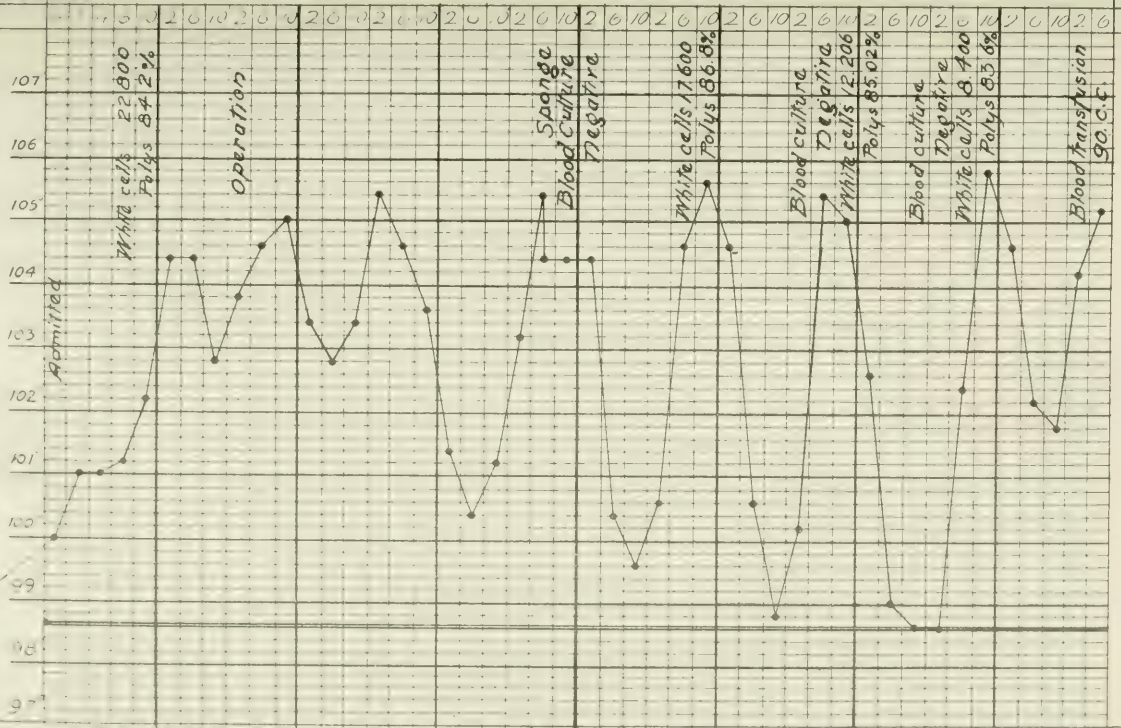
CHART I

Name

Date 28 29 30 31 April 1 2 3 4

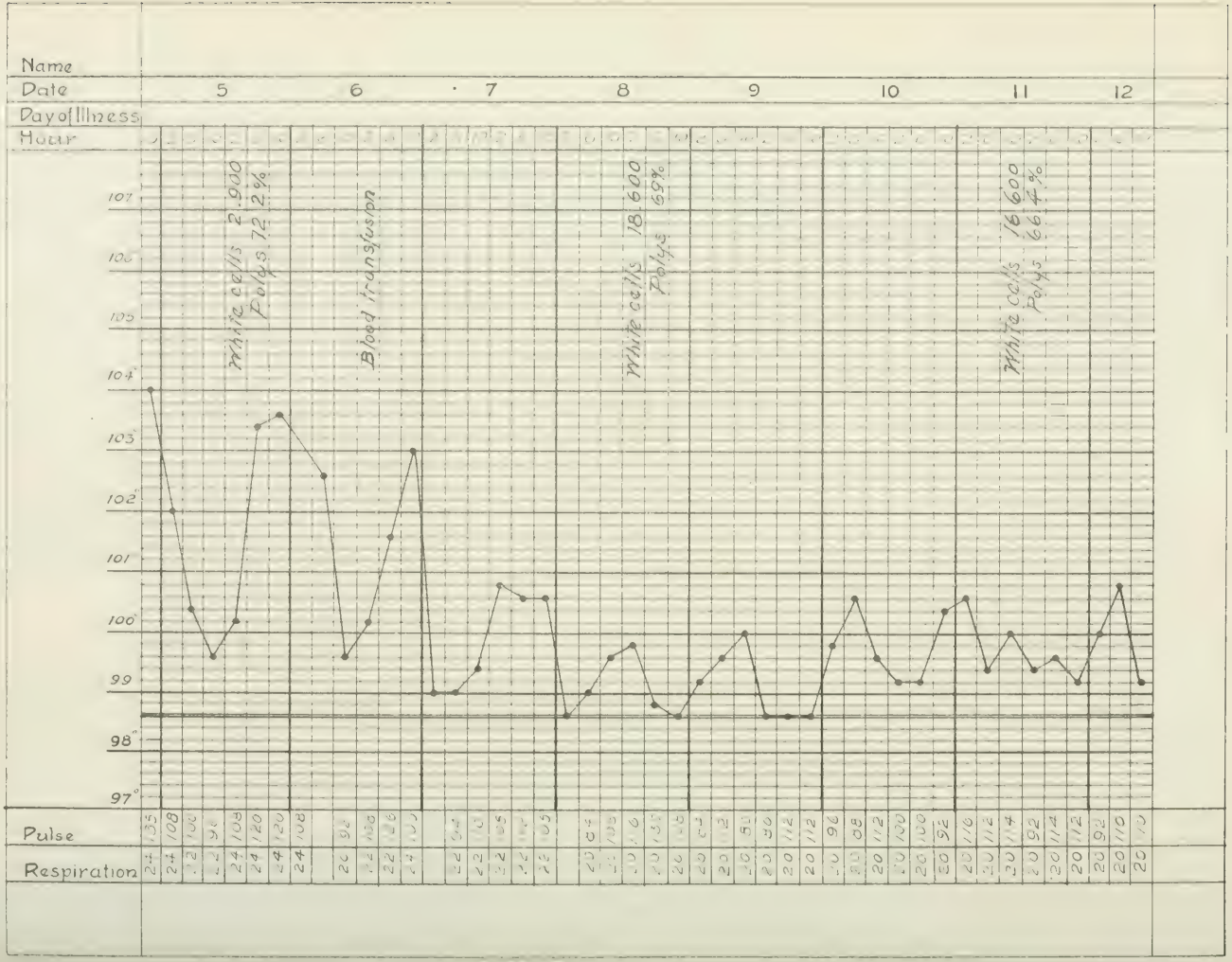
Day of Illness A M

Hour



Pulse

Respiration


Name
Date
Day of Illness
Hour
5
6
7
8
9
10
11
12
107
106
105
104
103
102
101
100
99
98
97
White cells 2,900
Polys 72 2%
Blood transfusion
White cells 18,600
Polys 69%
White cells 16,600
Polys 66 4%
Pulse
Respiration

Name
Date
13
14
15
16
17
18
Day of Illness
Hour
2 6 6 10 6 6 10 2 6 6 10 2 6 6 10 2 6 8 11 3 6 8 11 3 6
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Pulse
Respiration

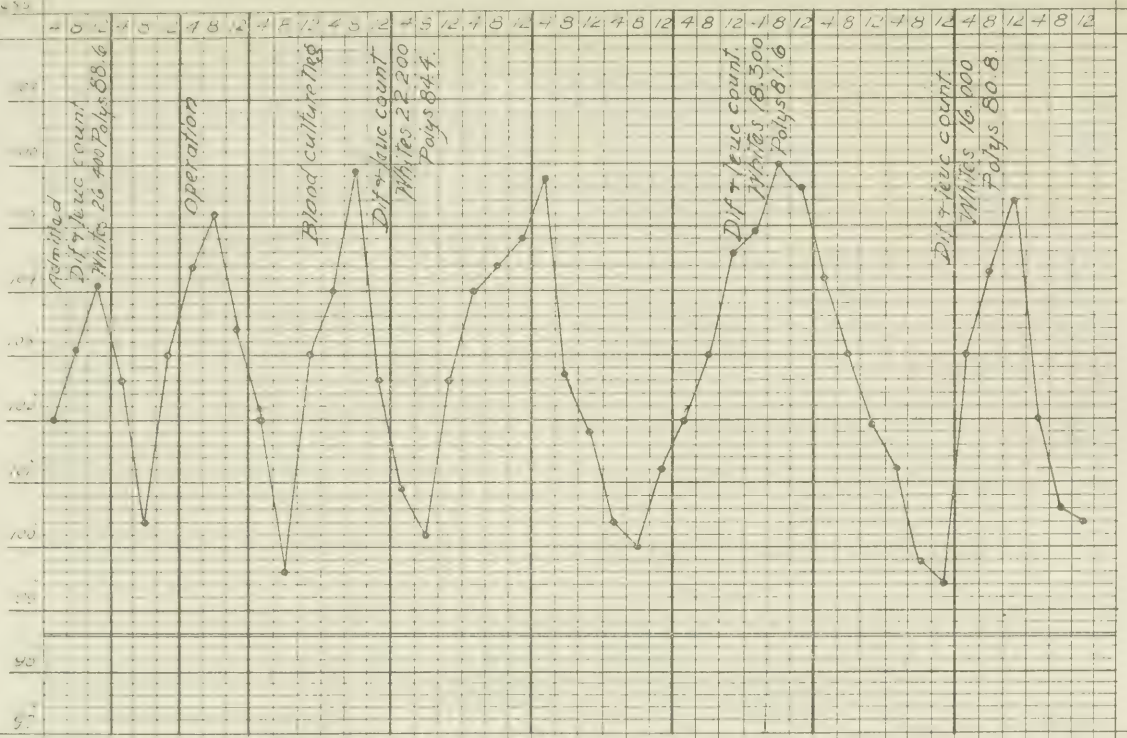
dressing. On the tenth day, a blood transfusion from vein to vein was given. Eighty c.c. of blood was injected, the donor being the father. The introduction of this blood, as will be seen by a study of the chart, had a marked antipyretic effect during the next thirty-six hours. There was general improvement in the little one's condition which continued for four days. On the fifth day following, another transfusion was given, 70 c.c. of blood was injected, and from this time there was a general reduction of the temperature, as well as a rapid general convalescence. The wound cavities improved, and ten days after the first transfusion the bone was covered with healthy granulations. Duration of healing on both sides was seven weeks and two days from the date of operation.

Case No. 3. Baby, male. Age, ten months. Double mastoid. Duration of aural suppuration one week. Duration of mastoid infection two days. Predominating microorganism streptococcus haemolitica. Differential and leucocyte count three days prior to operation gave the number of white cells as 24,200. Polynuclear percentage 82.6. Below is the temperature chart from the date of operation for four weeks following. During the first two weeks three blood cultures were taken, and several differential and leucocyte counts, the results of which are recorded on the chart. For the first ten days after operation there was practically no healing of the wounds whatever, the bone in both mastoid cavities remaining white, and showing no reparative process. On the tenth day an intramuscular injection of 50 c.c. of blood was given, the donor being the father. The site of the injection was the right gluteal region. The reason for giving the blood in this way was because of the general collapsed condition of the little patient's veins,—an attempt having failed to give it direct from vein to vein. The improvement in the little one's general condition began to show twelve hours after the introduction of the blood, and there was a marked reduction in the temperature twenty-four hours after the injection.

Five days later a second injection of 40 c.c. was given in the left gluteal region, and from this time on the child made

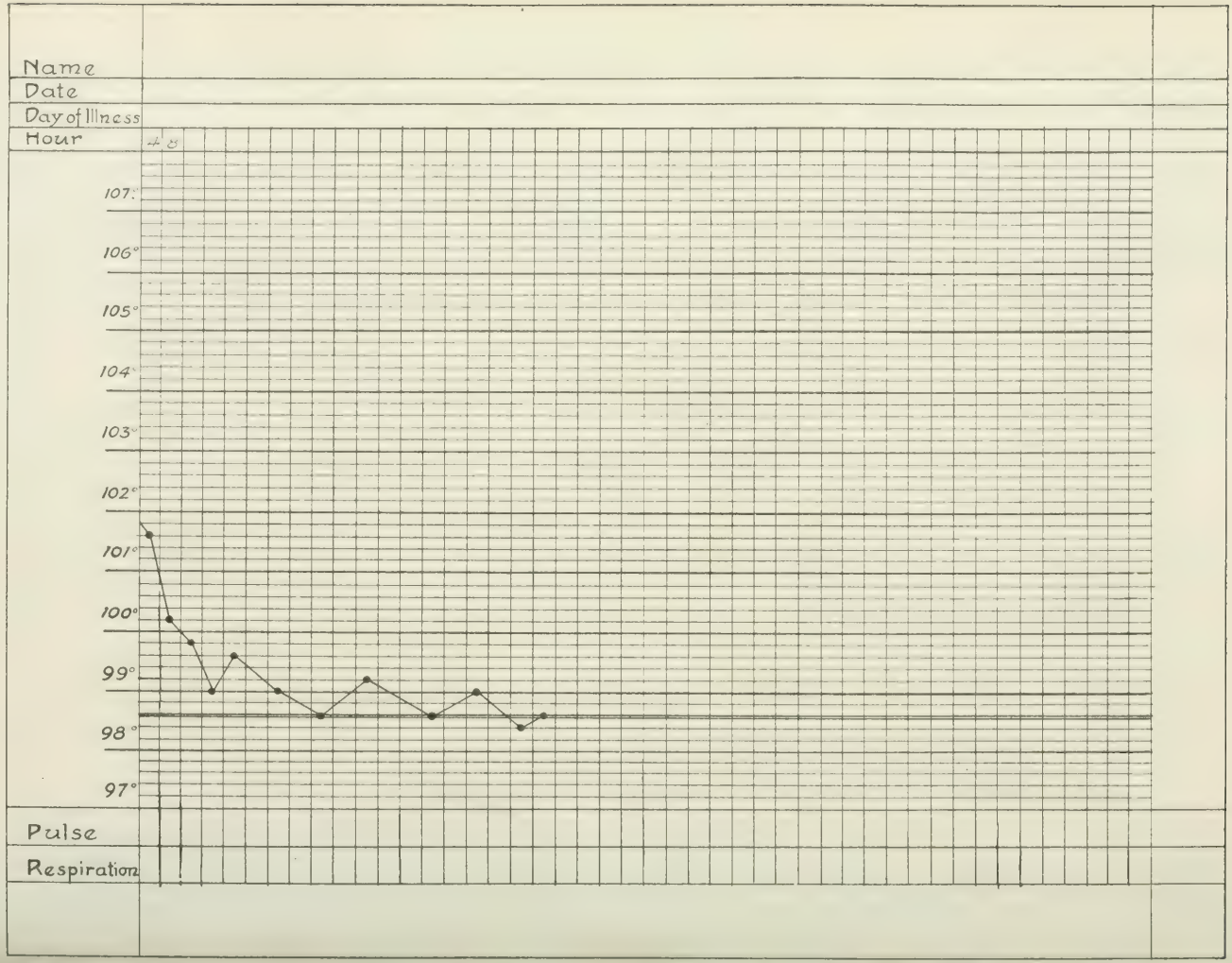
CASE 2

Name
Date
Day of Illness
Hour



Pulse — Highest 174. Lowest 82.

Respiration


Name
Date
Day of Illness
Hour
4 8
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Pulse
Respiration

an uninterrupted recovery. The healing was rapid, and there was a most gratifying general improvement. Both wounds were completely healed in six weeks.

Case No. 4. Baby girl, 22 months old. Double mastoid. Duration of aural suppuration twenty-six days. Probable duration of mastoid infection two weeks. Predominating microorganism streptococcus haemolitica. No blood examinations were made prior to operation. The patient was profoundly septic and did not rally at all well from the operation. Below is the temperature chart from the date of operation with the blood records. On the fourth day 54 c.c. of the father's blood were injected intra-muscularly in the right gluteal region. A distinct general improvement was noticeable in twenty-four hours. Four days later a second blood injection of 46 c.c. was given in the left gluteal region. From this time on the patient improved rapidly, though her convalescence was prolonged on account of the extremely septic condition before operation.

Case No. 5. Boy, 3½ years of age. Left mastoid. Duration of aural suppuration nine days. Probable duration of of mastoid infection six days. Predominating microorganism streptococcus haemolitica. Mastoid extensively involved with dural exposure over knee of sinus and floor of middle fossa. No blood examinations were made prior to operation. Below is shown the temperature chart upon which are recorded the results of the blood examinations. On the fifth day following operation 65 c.c. of the mother's blood were injected in the right gluteal region. Within 36 hours a very distinct general improvement was noticeable, as will be seen by the chart. Four days later a second injection of 50 c.c. of blood was given in the left gluteal region, and from this time on there was a rapid convalescence with normal healing of the mastoid, due, I attribute largely, to the early introduction of the blood.

A word of precaution as to the selection of the blood. Preferably the father's or mother's blood should be used. A haemolysis test should always be made between the blood of

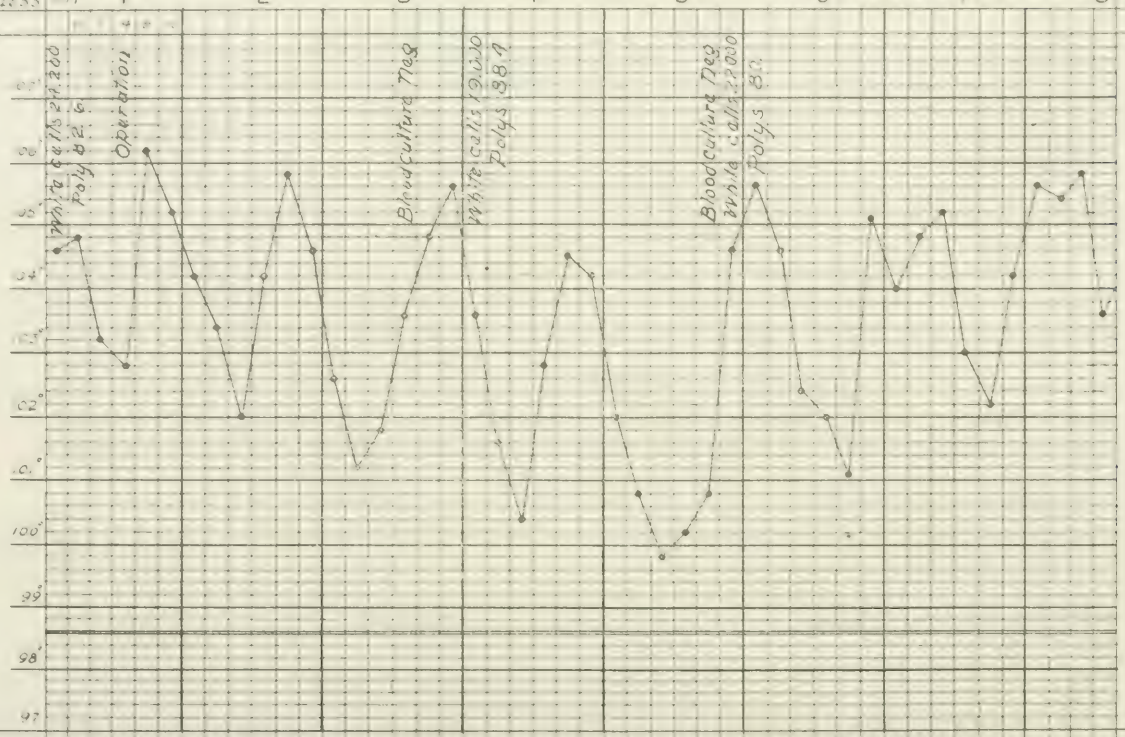
CASE 3

Name

Date

Day of Illness

Hour



Pulse — Highest 180. Lowest 78

Respiration

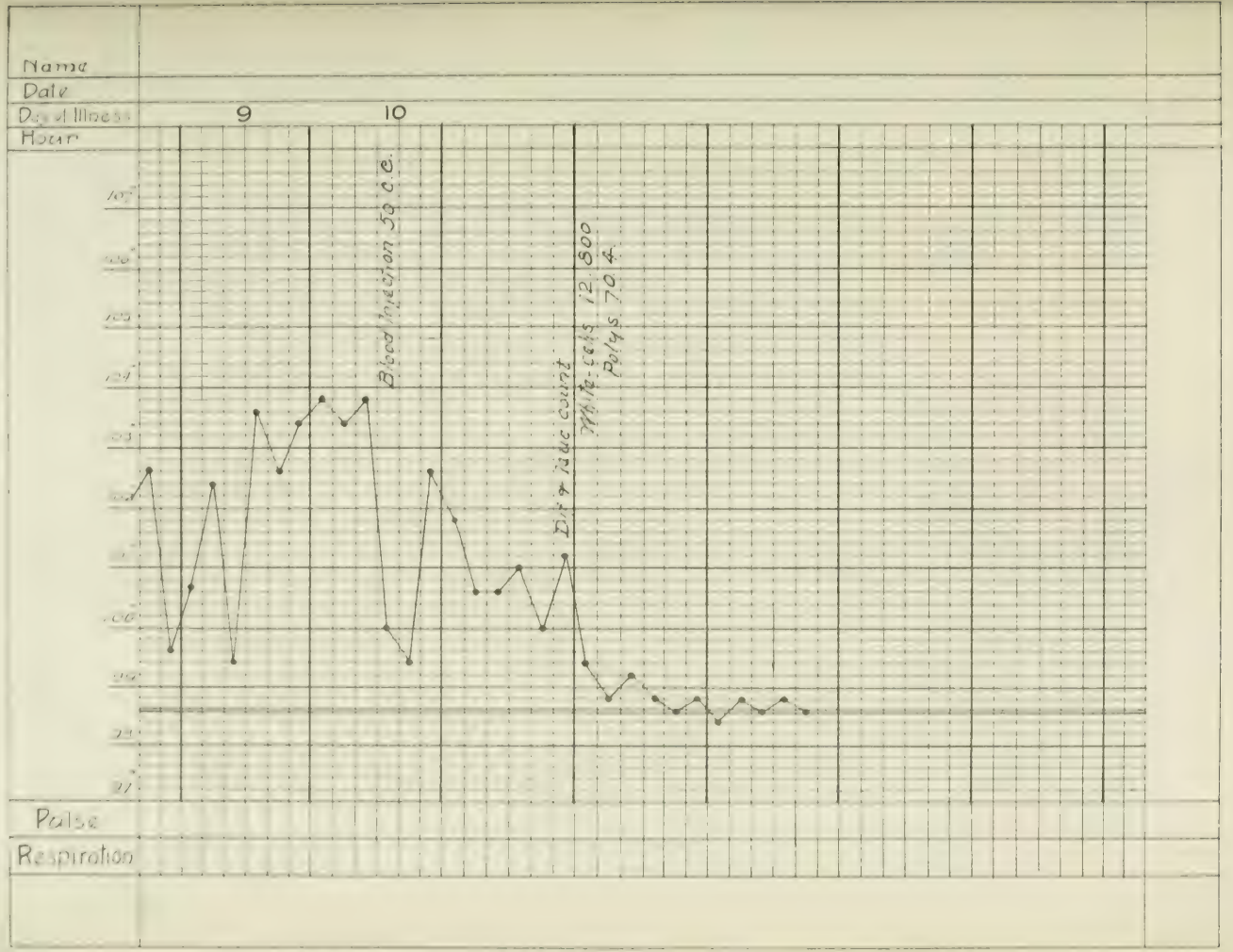

Name
Date
Day of Illness
Hour
9
10
Blood Infection 5g. c.c.
Diff. & Arc count
White cells 12,600
Polys. 70.4
Pulse
Respiration

CHART IV

Name

Date

Day of Illness 1 2 3 4 5 6 7 8 9 10 11 12

Hour 12 4 8 8 12 4 8 12 4 8 12 4 8 8 12 4 8 8 12 4 8 8 12 4 8 8 12 4 8 8 12 4 8 8 12 4 8 8 12 4 8 8 12 4 8 8 12

107° 106° 105° 104° 103° 102° 101° 100° 99° 98° 97°

Admitted 2 P.M.

Operation

White cells 19,200 Polys 82.2%

Blood culture Negative

White cells 25,100 Polys 84.8%

Blood injection

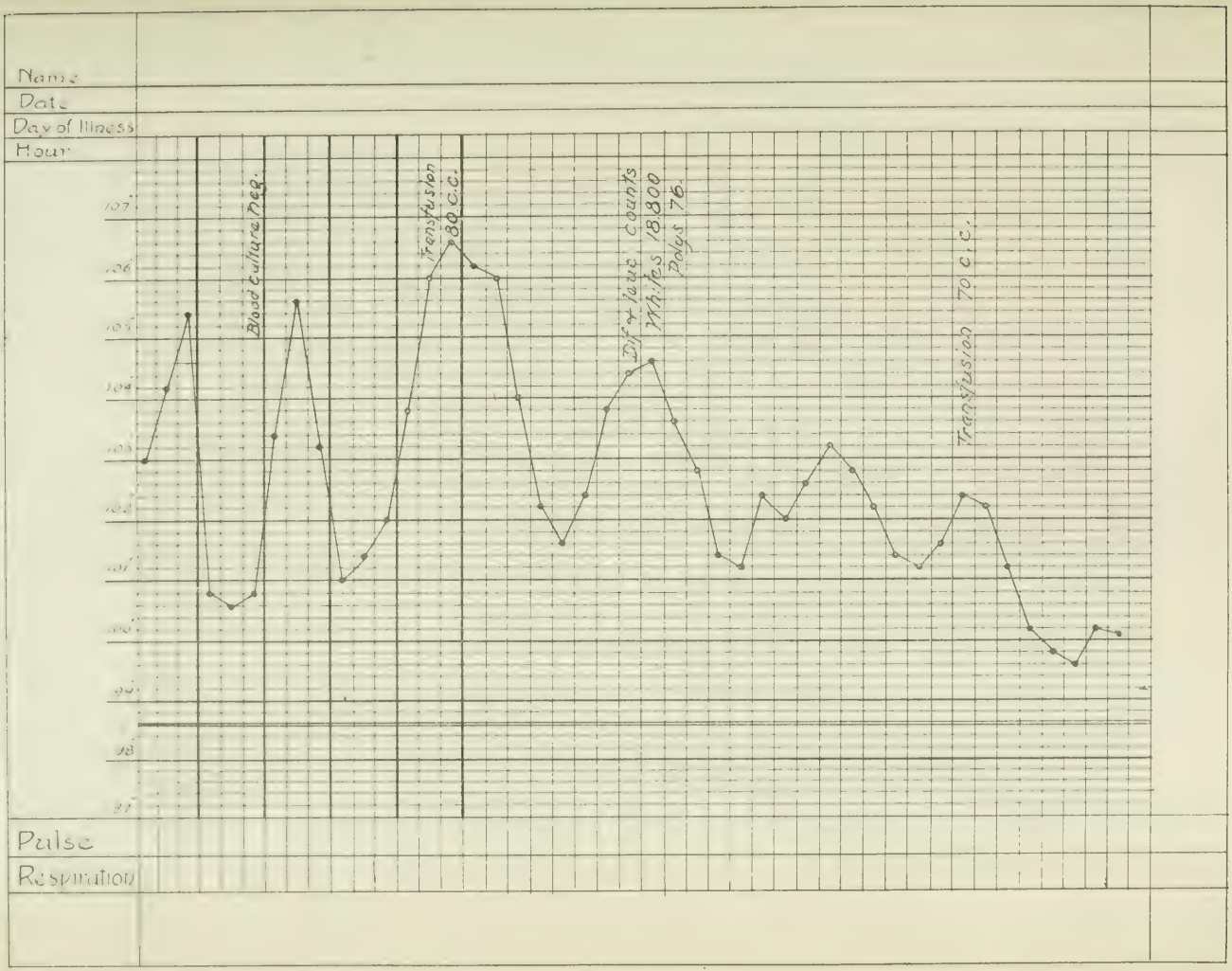
White cells 14,400 Polys 72.8%

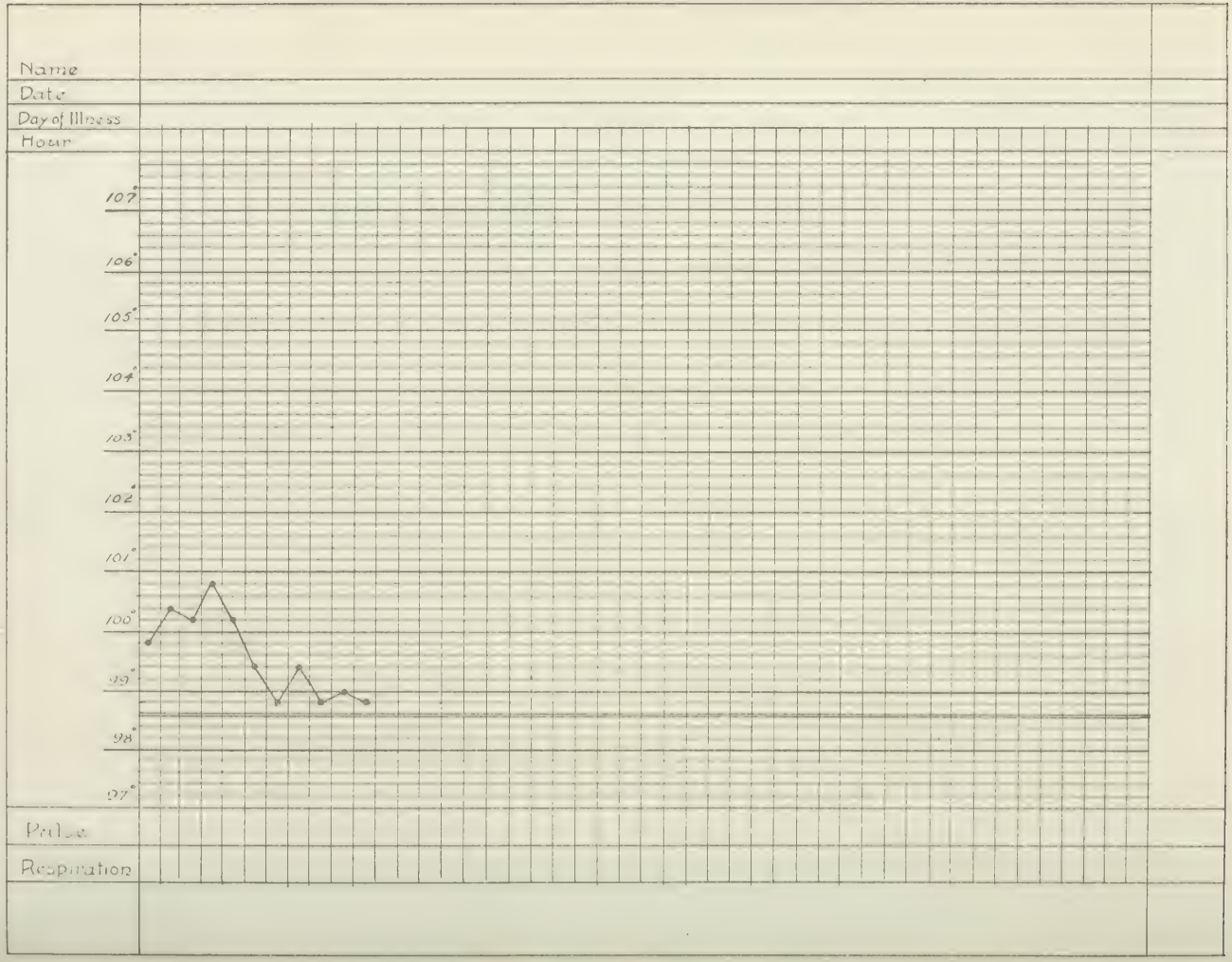
Blood injection 46 c.c.

White cells 14600 Polys 69.6%

Pulse

Respiration


Name
Date
Day of Illness
Hour
Blood Culture Neg.
Transfusion 80 c.c.
Diff. Leuc. Counts
Trans. Pes. 18800
Polys 76.
Transfusion 70 c.c.
107
106
105
104
103
102
101
100
99
98
97
Pulse
Respiration


Name
Date
Day of Illness
Hour
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Pulse
Respiration

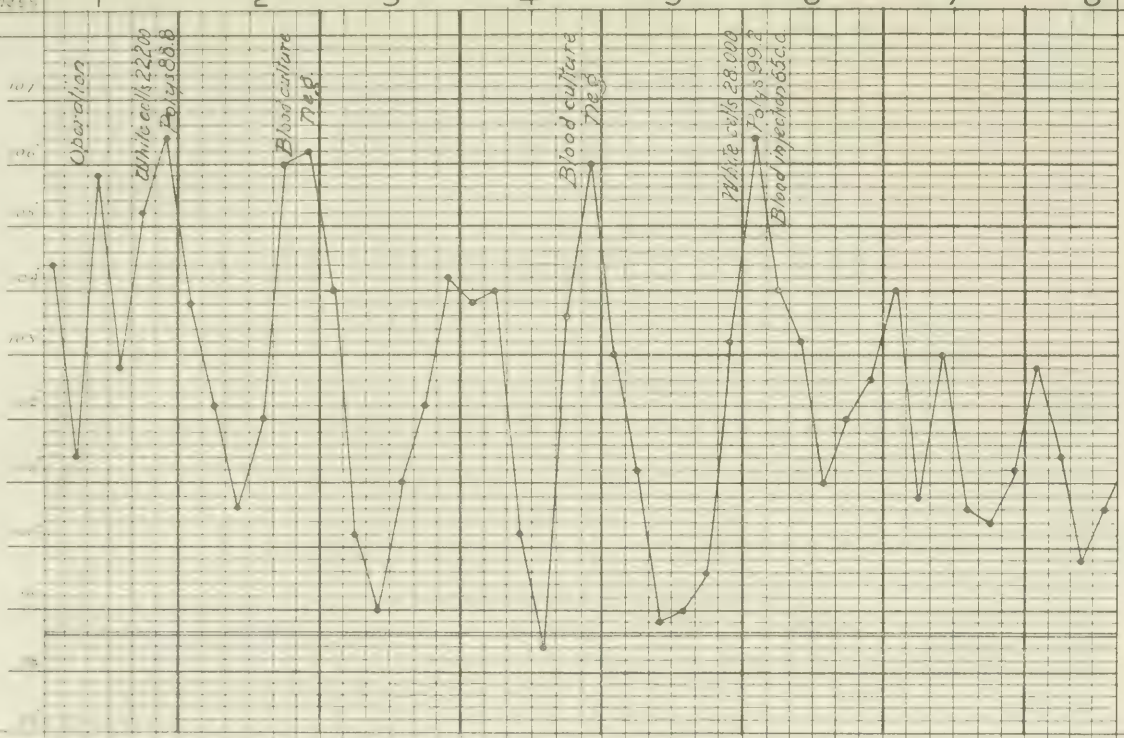
CASE 5.

Name

Date

Day of Illness

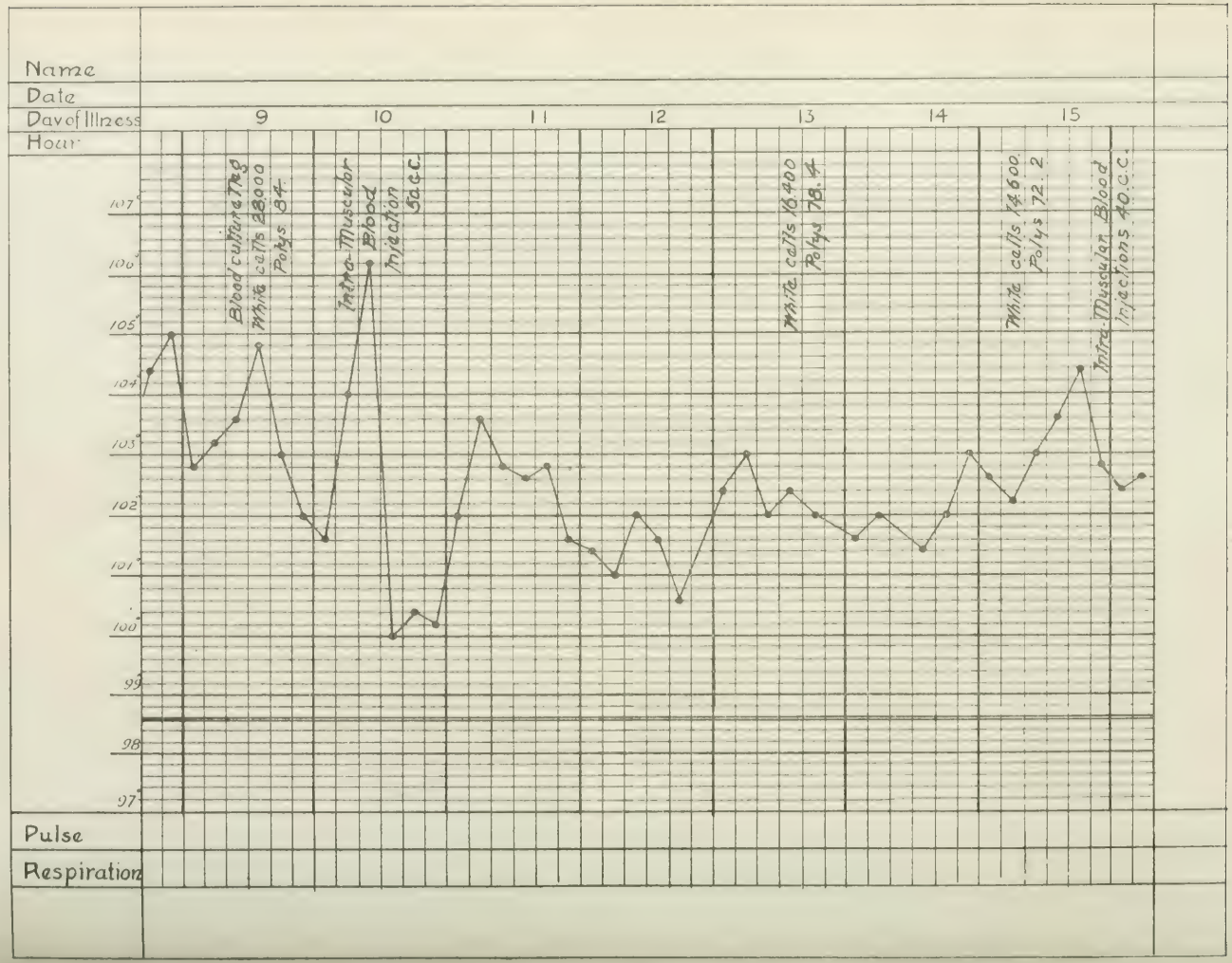
Hour



Highest 160 Lowest 92.

Pulse

Respiration


Name
Date
Day of Illness
Hour
9
10
11
12
13
14
15
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Blood culture Neg
White cells 28000
Polys 84
Intra-Muscular Blood Injection 5 c.c.
White cells 16,400
Polys 78.4
White cells 14,600
Polys 72.2
Intra-Muscular Blood Injections 40 c.c.
Pulse
Respiration

Name
Date
Day of Illness
16
17
18
Hour
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
Pulse
Respiration

the donor and the receiver, in order to determine its suitability prior to its use. If a second transfusion be given within five days of the first, it is not necessary to have another haemolysis test made; but if a longer period than six days should elapse between the first and second transfusion, it is always wise to have a second haemolysis test made. Should the donor be other than a member of the patient's family, a Wassermann should be taken in addition to a haemolysis test. If the veins of the recipient are such that they can be easily entered, then the direct method of transfusion is preferable, as the resulting improvement is more rapid. But in many cases of young children—especially if there has been much general depletion, it is almost impossible to introduce the blood intravenously, and rather than subject them to a prolonged and tedious trial, it is much simpler to inject it deeply in the gluteal region. As many as 80 c.c. of blood can be used in this way without removal of the canula. Its maximum effect is however delayed, when introduced in this way.

Nevertheless the patients show a decided improvement in 18 to 24 hours, and by the third day the maximum seems to be reached. It is needless to say that strict antiseptic precautions are to be observed in its withdrawal and introduction. In both methods of transfusion a set of modified lindeman syringes were used.

The rapid convalescence of the last two cases reported is believed to be due to the early introduction of the blood. In all of the five cases the reparative process in the mastoid wounds was at a standstill until after the initial use of the blood. When this was used the healing was apparently as rapid as in wounds unaccompanied by a general sepsis.

The writer believes that many cases of post-operative sepsis can be saved, secondary operations avoided, and patients placed upon a basis for rapid and complete recovery, if this most valuable aid is used.

Discussion.

Dr. Edward B. Dench, New York City, had had no experience with the method detailed by the essayist, but recalled one case in the Hospital in which a positive blood culture was made. He had suggested transfusion to one of the staff, but the latter said it would do no good. He asked Dr. McKernon if a positive blood culture was a contraindication to the method.

Dr. T. Laurance Saunders, New York City, cited a case in which blood, taken from the father, was transfused through the anterior fontanelle. Double mastoiditis was followed by erysipelas and abscess, the child's temperature was subnormal and its vitality at a very low ebb. Immediately after the transfusion the temperature rose to 104 degrees, but came down shortly afterward. The child's improvement dated from the time of the transfusion.

Dr. McKernon, in closing the discussion, said he had employed the method twice last winter in persons with positive blood culture, after removal of the sinus, with absolutely no improvement. One patient was an adult, the other a child. He had also used it in one case in which operation was refused. He did not wish to be quoted as saying that this is a positive cure for streptococcic empyema, but he had had three cases with positive culture, in which three transfusions, forty, sixty and eighty c.c. of human blood was used, respectively, from the onset, were followed by no constitutional disturbances whatever. It was not necessary—and in this he had been borne out by laboratory workers—to have a hemolysis test made where the blood donor was the father or the mother, unless the blood was to be thrown into a vein.

THE STAPHYLOCOCCUS PYOGENES ALBUS IN AURAL SUPPURATIONS.

By ARTHUR B. DUEL, M. D., New York City.

Abstract of Case.

A brief clinical report of a fatal case in which the infecting organism, a virulent staphylococcus albus was not suspected as the cause of the patient's desperate illness until very late. Streptococcus viridans credited with the responsibility for continued high leucocytosis and high polymorphonuclear percentage lasting for weeks with practically normal temperatures. Repeated negative blood cultures misleading as to the diagnosis of sinus thrombosis. Final outbreak of symptoms classically pointing to sigmoid sinus thrombosis—chills, wide vacillations in temperature at short intervals, retinal hemorrhage, petechiae. Still negative blood cultures, exploration of sinus on indubitable clinical picture, despite absence of laboratory confirmation, reveals disintegrating thrombosis with thick pus in sinus showing pure culture of staphylococcus albus. Study of the case points to importance of differentiating different types of staphylococcus albus, an important field of work which Dr. Dwyer has undertaken, and the results of which he is about to report.

A PRELIMINARY REPORT ON STAPHYLOCOCCUS PYOGENES ALBUS INFECTIONS.

By JAMES GARFIELD DWYER, M. A., M. D., New York, N. Y.

The identity of some well known bacteria is being doubted by progressive bacteriologists, as variations in the so-called "characteristic properties," which serve as a criterion in the differentiation of bacteria suggest the possibilities that our predecessors have confused bacteriological terminology by assigning names to many variations of the same organism, when growing under widely dissimilar circumstances. Much valuable knowledge will undoubtedly be obtained by a review of the subject in the new light. It has for years been known that the grouping together of organisms, having similar morphology, cultural characteristics, etc., but no pathogenic relationships must be only an affair of necessity and such grouping only awaited modern bacteriological and serological developments to undergo such radical changes that it would revolutionize our present conceptions. Such relationships between the pneumococci have been successfully accomplished: that of the streptococci is being done and the writer in his small way is now attacking the problem of the staphylococci along the same lines. The question of the unity or multiplicity of the staphylococci is still unsettled. The recent work of Rosenow throws new light on the whole subject and indicates that if distinct species exist, rapid mutations from one to the other may occur. The fact remains however that as we meet them in nature, staphylococci differ widely in their microscopic appearances, their manner of growth, their metabolic activities and especially in their pathogenic activities. We meet with strains that grow on healthy or even abraded mucous membranes without any tendency to invade or produce a reaction in the host. We meet with others that set up generalized infections of the most severe type and with all gradations between the two types. Whether we regard

these as distinct species or as variants of the same species, it is of obvious importance to determine with which type we have to deal in any given case. Numerous tests have been devised to this end but there seems to be no agreement as to their value. Virulence for small animals does not seem to run parallel with that for human beings and the classification according to hæmolytic power, the method most used and to pigment formation is in many ways unsatisfactory.

Before going into our own work, it would be interesting to report in extenso the cultural and pathogenic characteristics of the organism isolated in Dr. Duel's case—S. P. Albus, strain1. This organism answered all the cultural characteristics of the typical S. P. Albus. At no time did it form pigment, a characteristic of the aureus strains and the more commonly regarded pathogenic organism. Liquefaction of gelatin was very slight. Now, as regards pathogenicity, guinea pigs were the animals with which all this work was done, as we had worked for the last two years in the production of staphylococcus anaphylatoxin in our experiments on active anaphylaxis. One-third of a 24-hour slant agar culture, emulsified in salt solution was able to kill a guinea pig of 250 grammes weight in 3 to 5 days. A very ingenious method of producting the classical picture of pyaemia at will in guinea pigs was suggested to the writer as an experiment by Dr. J. G. Hopkins, of our department at Columbia University. By this method, we could always be sure of producing pyaemia at varying intervals and closely simulating that occuring in man. This simple method consisted in etherizing a guinea pig, tying off a section of the jugular vein, about an inch long and allowing the blood to clot in this section. After a day or so in some cases, the pig was again etherized, and very carefully, an emulsion of the culture was introduced into the clot. It is essential not to spill the culture in the surrounding tissue. As the days pass then, we have the phenomenon of liquefaction of the clot, the liquefaction necrosis of nature, the breaking down of the clot, the discharge of the small masses of clot (this is an important point, it not being the individual organisms) and

the formation of septic thrombi and miliary abscesses in other parts of the body, an exact analogy for the type seen in Dr. Duel's case. Again, time and again in the experimental animals, we had the enlargement of the cervical glands, an effort of nature to shut off or localize the infection and very often a symptom that is misinterpreted as an abscess of the neck, a beginning Ludwig's angina, etc. The reason for negative blood cultures in such cases is apparent, as it is the masses of debris and not individual organisms that are discharged into the system, probably only at intervals and hence unless they are caught on the fly so to speak, the cultures may be always negative. A negative blood-culture has usually no meaning. The case of Dr. Duel shows infection with an organism of low but persistent pathogenic power, calling forth a tremendous leucocytic activity to combat the infection, with the original focus feeding in all the time and overcoming the tremendous efforts by nature. This is the usual history also in endocarditis due to staphylococcus, where at times the blood sterilizes itself and then becomes reinfected and thus pursues the vicious circle until the end.

Serologically, we could demonstrate slight agglutination reactions with serum from animals immunized against this organism, the immune serum not running up very high in titration.

Regarding hæmolytic power. This organism, even when freshly isolated, never showed any hæmolysis, one of the marks usually of virulence. Even when passed through a succession of animals, thereby increasing its pathogenic power, hæmolysis was absent. It was probably due to this point that no petechial hemorrhages occurred in the above case.

Regarding pigment formation—under the most favorable circumstances, no pigment has ever developed. If one analysizes the factors back of pigment formation, he will find it hard to understand why the property of pigment formation was ever used to differentiate organisms, as we know that under easy laboratory technique, we can vary at will the production of pigment.

The above is a resume of the properties of this one strain, leaving out of course the ordinary cultural characteristics that are known to all. Since this first case came to our knowledge with such a dire result, we have isolated, in the usual work, three other strains, in mastoiditis and are investigating them in the same way.

During the last few months, we have started out in our small way to try and classify the various groups of staphylococci, as isolated from lesions, that is the pathogenic strains, and in doing this we are following the paths that have been marked out for us in the classification of pneumococcus, where the classification is based on serum immune reactions and that in the classification of streptococci, where it is based on fermentation reactions, the splitting up of carbohydrate and the production of hæmolysis. The problems we have set out to try and solve are as follows: Is hæmolysis a constant characteristic of certain organisms or strains of organisms? Is pigment formation a reliable factor upon which to base conclusions? Is the ability to ferment carbohydrates and allied substances a constant characteristic of strains of staphylococci as it is of members of the typhoid-colon dys. group of bacilli and consequently a sound basis for classification?

As this is only a preliminary report, I will deal with the first question only—that of hæmolysis. This method, introduced by Schottmuller, is one that is very much used. We are working with strains isolated from many sources and they fall into three classes:

(1) Definitely pathogenic. Strains obtained from the blood of infected patients or from closed suppurative processes. Such a strain was in Dr. Duel's case. Such also those isolated in blood culture, those from mastoid cavities, etc.

(2) Probably pathogenic. Strains obtained in mixed culture from inflammatory exudates, or pus, such as in membraneous rhinitis, where it was the only organism isolated: at autopsy from frontal sinus, and ethmoid cells, etc.

(3) Probably saprophytic, from normal throats, under the finger nails, etc.

For hæmolysis, we examined most of our strains by making surface streaks on human blood agar and observing them for two or three days. Some strains produced no hæmolysis at all. Others from blood culture produced a wide zone in twenty-four hours. Between these two extremes were all gradations. The hæmolysis depended seemingly to some extent on the depth of the medium and the amount of blood in it, for if the blood were unevenly mixed, it was sometimes observable in the thin but not in the thick portions. Moreover, some strains that first showed slight hæmolysis later lost the hæmolysis entirely. Thus we have all gradations. It is difficult to draw a line sharply between hæmolyzing and non-hæmolyzing types. The property is present to some extent in most strains and while as general rule, it is more pronounced in the more virulent type, the differences are quantative and therefore not satisfactory as a basis of classification.

We expect to continue this investigation, which from the essential nature of the work will take considerable time and hope to report something in the future.

Discussion.

Dr. James E. Logan, Kansas City, Mo., had had under his care, last September, a young man, twenty-six years of age, who presented practically the same history as the case reported by Dr. Duel, except that there was no history of middle ear infection when the patient consulted him for slight pain in the right ear. There was no bulging of the tympanic membrane, no swelling over the mastoid region. On the second day the membrane ruptured. The discharge was very slight, and showed pure staphylococcus albus infection. At no time were other organisms found, despite repeated examinations by the pathologist. At no time was there a leucocyte count of more than ten thousand, and seventy-two per cent. polymorphonuclears. The tempera-

ture ranged from normal to 99⅖°, and the pulse from 75 to 86. The man went home for the Christmas holidays. On Christmas day he telephoned that he was all right. He went out to Christmas dinner, and that night fell into the hands of an osteopath and a Christian scientist. The following day the speaker was telephoned to make arrangement for the patient's admission to the hospital. Examination revealed extensive cellulitis, extending over the mastoid. The radical mastoid operation was performed. Pus was found in the antrum. There was no destruction of mastoid cells. The tip was opened, and a clean cavity found. At the time of the operation the leucocyte count was about twenty-four thousand, and the poly. count eighty-six. The cellulitis extended over the neck. At a second operation he went down behind the sternocleidomastoid muscle, cleaning out posteriorly. Pus was found each time, of very offensive odor. The patient died on February 23, of endocarditis. The temperature ran up as high as 105 degrees. From the very inception it had seemed that death was written on the man's face. There was never any evidence of mixed infection. The blood culture showed no bacteremia. The urine was never abnormal, the patient was never unconscious, and there was never any pain except, as in Dr. Duel's case, posterior to the emissary vein.

Dr. Norval H. Pierce, Chicago, Ill., mentioned a case, previously reported before the Society, of ordinary otitis media purulenta, in a man in the thirties. On account of slight pain and continuous elevation of temperature the mastoid was opened, with negative findings, except for a slight amount of pus, which proved to be staphylococcus, pure culture, as he recalled it. The sinus was apparently healthy. He was recalled from a meeting of the Society, by telegram, because the man's temperature had shot up a few days after the operation. Upon opening the wound he found the bone over the sinus apparently healthy. He uncovered the sinus and found a thrombus extending about an inch in the region of the knee. This was removed. There was free hemor-

rhage from the ends. The wound was packed open. The progress of the case was not at all satisfactory, so that subsequently the jugular vein was exposed and dissected out. The patient died in the course of about two months after the original operation. Abscesses had developed in the soft parts of the arms and in one ankle. In all of these abscesses the staphylococcus was found.

Dr. S. MacCuen Smith, Philadelphia, Pa., had been especially interested in the bacteriological side of Dr. Duel's patient, because of the similarity of a case which had recently come under his care. The patient, a child seven years of age, was operated upon for acute mastoiditis. The staphylococcus albus was found. The child ran a very septic temperature. About ten days after the operation endocarditis was discovered. There were some chills and sweating. He was urged to operate again, but refrained. The patient died and autopsy was performed. Dr. Duel deserved great credit for his courage in going through with a case such as the one reported.

Dr. Edward B. Dench, New York City, emphasized the point, suggested by the first part of the history of Dr. Duel's case, that an acute otitis media which clears up is still a dangerous condition. A great many deaths were due to otitis which had cleared up, but which had left a focus in the mastoid. He would almost rather see an acute otitis go on to mastoiditis unless drained in twenty-four to forty-eight hours.

Dr. Eugene R. Lewis, Dubuque, Ia., recalled a case, reported before the Society two years ago, in which there was a very high temperature (107 degrees), with staphylococcus infection, and no other symptoms except slight tenderness over the emissary vein. He operated for sinus thrombosis, finding the vein all broken down, with absolute occlusion between the knee and the bulb. He did not know whether the staphylococcus was of the aureus or albus type.

Dr. Sargent F. Snow, Syracuse, N. Y., reported a case in which two examinations of the discharge from the ears showed

staphylococcus infection, whether aureus or albus not being stated in the bacteriological report. After about four weeks one ear healed and the other continued to discharge. The patient was then admitted to the hospital with all the symptoms of mastoiditis except prolapse of the posterior wall. The cellulitis was marked and extended down to the angle of the jaw. The usual mastoid operation was performed, with absolutely negative findings. The symptoms cleared up. A boggy condition of the throat on the side of the infected ear, which had suggested quinsy, also cleared up. The patient seemed to be doing very well for about two weeks, when he developed joint symptoms and endocarditis. Examination of the blood showed streptococci infection. The patient died, and autopsy disclosed the fact that there was a septic condition in the walls of the lateral sinus, from which a pure culture of streptococcus was obtained. He had never been able to decide whether the streptococcic infection had come from the middle ear or from the diseased tonsil. He did not open the lateral sinus at the time of the mastoid operation because of its apparently healthy condition.

Dr. J. J. Thomson, Mt. Vernon, N. Y., presented the following case history, which seemed to be related to the case reported by Dr. Duel:

Case of Miss L. B.

Patient first seen April 22, 1917. History: Patient recovering from a severe attack of tonsilitis. Had pain in the left ear for twenty-four hours before seen. Examination showed an acute otitis media; drum was opened. Scant discharge followed for two days, but considerable bleeding also from the canal.

April 25, 1917: Patient seen again. Left side of throat was edematous, and showed a haematoma, the result of a small incision made by the attending physician. There was also marked swelling of the left auditory canal; some edema over the mastoid, temperature 103°, pulse 98; patient pale and her general appearance did not look well.

April 27: Patient complained of severe headache; temperature 105°; area of œdema over mastoid has extended; general condition not as good; canal markedly swollen—membrana tympani could not be seen, and only a scant discharge, a culture of which showed staphylococcus aureus. Throat condition unchanged and patient vomited once today. No chill. Specimens taken for laboratory tests.

April 28: Condition of throat, mastoid and ear unchanged. Temperature 106°, pulse 118. General condition same; no nystagmus, fundi normal, no Kernig or Babinski, and some hearing. Urine normal, except a slight trace of albumin; widal and diazo negative. Blood examination showed leucocytes 18,606, ploynuclears 86%, lymphocytes 10%, mononuclears 4%, no eosiniphiles, and a marked pus reaction. Blood culture negative. Fluid from spine: 22 c. c. removed—fluid under pressure and slightly hazy; 180 cells per cmm. Trace of lactic acid, carbohydrate normal, no globulin; increase, cells, 62% polynuclears, 30% lymphocytes, and no bacteria seen; cultures on bouillon agar and blood agar were negative after twenty-four hours, and remained so subsequently.

April 29: Mastoid moderately tender, edema extending over mastoid and into scalp; canal swollen—some discharge from the middle ear. Throat condition clearing up. Patient seen in consultation by Dr. Berens, who advised opening the mastoid as soon as the general condition of the patient would permit. From this time the patient's condition rapidly improved. Temperature did not reach higher than 102° at night and ranging about 99° to 100° in the morning; no chills or sweats; no headaches and appetite improved. Ear discharged freely, edema over mastoid and in the canal subsided; fundus of canal looked very edematous, and there was only slight tenderness on the mastoid, which can, however, always be elicited on deep pressure. By May 6th, the temperature was normal, and continued so until the time of operation. Patient felt well, was allowed out of bed, appetite was

good, had no pain or complaints and slept well. Oedema entirely disappeared and the ear continued to discharge freely. There was slight mastoid tenderness some days only, and other days greater. Membrana tympani appeared very boggy.

Operation May 18th: Simple mastoid operation; mastoid cells broken down; fluid pus filled the cavity over a large area backward and downward, the entire posterior aspect of the tip being destroyed. Large epidural abscess over lateral sinus and cerebellum in front of the sinus. Sinus dura over cerebellum was very dark and not covered with many granulations. Outer sinus wall perfectly white and on incision the sinus discharged about two drachms of creamy pus—culture from this pus failed to show any growth. The jugular was ligated below the omo-hyoid and free bleeding obtained from the torcular end of the sinus, but no bleeding from the bulb.

May 25: Patient has done very well. The highest evening temperature being 101°. Patient sitting up in a chair today.

Dr. Stephen H. Lutz, Brooklyn, N. Y., asked if there had been any symptoms of endocarditis. (The question was answered by Dr. Duel in the negative.) He had seen three cases in which endocarditis developed. In one a staphylococcus was found, in one a pneumococcus, and in one a streptococcus.

Dr. J. Gordon Wilson, Chicago, Ill., considered that a case presenting so many unusual features well deserves the full report given. That the staphylococcus albus can cause so much trouble is well worth recalling, because we are apt at present to underrate the importance of this group.

TRANSACTIONS

OF THE

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FIFTY-FIRST ANNUAL MEETING.

HOTEL CHELSEA,

ATLANTIC CITY, N. J.

MAY 28 and 29, 1918.

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Dr. James F. McKernon, Secretary-Treasurer.
1909—Dr. Frederick L. Jack, President.
Dr. R. A. Reeve, Vice-President.
Dr. James F. McKernon, Secretary-Treasurer.
1910—Dr. Frederick L. Jack, President.
Dr. R. A. Reeve, Vice-President.
Dr. James F. McKernon, Secretary-Treasurer.
1911—Dr. Edward B. Dench, President.
Dr. Charles W. Richardson, Vice-President.
Dr. James F. McKernon, Secretary-Treasurer.
1912—Dr. Edward B. Dench, President.
Dr. Charles W. Richardson, Vice-President.
Dr. James F. McKernon, Secretary-Treasurer.
1913—Dr. James F. McKernon, President.
Dr. Eugene A. Crockett, Vice-President.
Dr. John B. Rae, Secretary-Treasurer.
1914—Dr. James F. McKernon, President.
Dr. Eugene A. Crockett, Vice-President.
Dr. John B. Rae, Secretary-Treasurer.
1915—Dr. Charles W. Richardson, President.
Dr. C. R. Holmes, Vice-President.
Dr. John B. Rae, Secretary-Treasurer.

1916—Dr. Charles W. Richardson, President.
Dr. C. R. Holmes, Vice-President.
Dr. John B. Rae, Secretary-Treasurer.
1917—Dr. Christian R. Holmes, President.
Dr. Norval H. Pierce, Vice-President.
Dr. John B. Rae, Secretary-Treasurer.
1918—Dr. Norval H. Pierce, President.
Dr. Ewing W. Day, Vice-President.
Dr. George E. Shambaugh, Secretary-Treasurer.
1919—Dr. Ewing W. Day, President.
Dr. Robert Lewis, Vice-President.
Dr. George E. Shambaugh, Secretary-Treasurer.

MEMBERS

OF THE

AMERICAN OTOLOGICAL SOCIETY.

Names of deceased members while in membership in full face.

HONORARY MEMBERS.

1875—Prof. A. Graham Bell	1331 Connecticut Ave	Washington, D. C.
1906—Dr. Albert H. Buck	Hewetts	Long Island, N. Y.
1908—Dr. J. Orne Green	267 Newbury St.	Boston, Mass.
1896—Sir William Macewen	3 Woodside Crescent	Glasgow, Scotland
1870—Dr. Arthur Mathewson		Washington, D. C.
1911—Dr. Thomas R. Pooley	40 East 41st St.	New York, N. Y.
1910—Dr. Jonathan S. Prout	Fishkill, Dutchess Co.	New York, N. Y.
1904—Dr. H. Luc	54 Rue de Varenne	Paris, France
1914—Dr. Samuel Theobald	Cathedral & Howard Sts.	Baltimore, Md.
1894—Dr. Alpheus E. Adams	Balmville, Cor. North St.	Newburg, N. Y.
1896—Dr. Henry A. Alderton	915 Channing Ave.	Palo Alto, Cal.
1904—Dr. Emil Amberg	David Whitney Bldg.	Detroit, Mich.
1880—Dr. Joseph A. Andrews	1229½ State St.	Santa Barbara, Cal.

MEMBERS.

1882—Dr. Gorham Bacon	47 West 54th St.	New York, N. Y.
1907—Dr. John F. Barnhill	Rooms 404-411 Penway Bldg.	Indianapolis, Ind.
1901—Dr. T. Passmore Berens	35 Park Ave.	New York, N. Y.
1908—Dr. Herbert S. Birkett	252 Mountain St.	Montreal, Canada
1912—Dr. Hugh B. Blackwell	148 West 58th St.	New York City
1869—Dr. Clarence J. Blake	226 Marlborough St.	Boston, Mass.
1904—Dr. Frank J. Blodgett	140 West 72nd St.	New York, N. Y.
1913—Dr. Charles R. C. Borden	520 Commonwealth Ave.	Boston, Mass.
1907—Dr. William C. Braislin	425 Clinton Ave.	Brooklyn, N. Y.
1903—Dr. Joseph H. Bryan	818 17th St. N. W.	Washington, D. C.
1894—Dr. W. Sohier Bryant	19 West 54th St.	New York, N. Y.
1904—Dr. Ernest U. Buckman	99 South Franklin St.	Wilkes Barre, Pa.
1908—Dr. Ralph Butler	1926 Chestnut St.	Philadelphia, Pa.
1917—Dr. Don M. Campbell	Smith Bldg.	Detroit, Mich.
1913—Dr. R. Bishop Canfield	300 So. State St.	Ann Arbor, Mich.
1885—Dr. Franklin P. Capron	118 Angell St.	Providence, R. I.
1901—Dr. James B. Clemens	10 East 71st St.	New York, N. Y.
1907—Dr. Cornelius G. Coakley	53 West 56th St.	New York, N. Y.
1917—Dr. Gerhard H. Cocks	137 East 54th St.	New York, N. Y.
1893—Dr. William Cowen	35 East 60th St.	New York, N. Y.
1901—Dr. Charles N. Cox	257 Jefferson Ave.	Brooklyn, N. Y.
1897—Dr. Eugene A. Crockett	298 Marlborough St.	Boston, Mass.
1906—Dr. J. Frank Crouch	513 North Charles St.	Baltimore, Md.
1907—Dr. Ewing W. Day	1005 Westinghouse Bldg.	Pittsburg, Pa.
1916—Dr. L. W. Dean	12½ S. Clinton St.	Iowa City, Ia.
1893—Dr. Edward B. Dench	15 East 53rd St.	New York, N. Y.
1897—Dr. Ernest E. Doble	52 Cross St.	Quincy, Mass.
1918—Dr. J. W. Downey	529 No. Charles St.	Baltimore, Md.

1904—Dr. Arthur B. Duel	27 East 57th St.	New York, N. Y.
1909—Dr. John Dunn	314 East Franklin St.	Richmond, Va.
1896—Dr. Wells P. Eagleton	15 Lombardy St.	Newark, N. J.
1916—Dr. Francis P. Emerson	520 Commonwealth Ave.	Boston, Mass.
1886—Dr. Joseph B. Emerson	40 East 41st St.	New York, N. Y.
1899—Dr. George F. Fiske	25 East Washington St.	Chicago, Ill.
1918—Dr. E. P. Fowler	616 Madison Ave.	New York, N. Y.
1906—Dr. Harry Friedenwald	1029 Madison Ave.	Baltimore, Md.
1911—Dr. Max A. Goldstein	3858 Westminster Place	St. Louis, Mo.
1888—Dr. George W. Hale	Wilcox Building	Nashville, Tenn.
1901—Dr. Thomas H. Halsted	831 University Block	Syracuse, N. Y.
1901—Dr. Philip Hammond	483 Beacon St.	Boston, Mass.
1903—Dr. Herbert Harlan	516 Cathedral St.	Baltimore, Md.
1903—Dr. Thomas J. Harris	104 East 40th St.	New York, N. Y.
1889—Dr. David Harrower	9 Elm St.	Worcester, Mass.
1896—Dr. N. Darrell Harvey	114 Watermann St.	Providence, R. I.
1906—Dr. William H. Haskin		West Point, N. Y.
1914—Dr. R. Johnson Held	616 Madison Ave.	New York, N. Y.
1901—Dr. Christian R. Holmes	8 East 8th St.	Cincinnati, Ohio
1880—Dr. Erastus E. Holt	723 Congress St.	Portland, Me.
1912—Dr. Frank T. Hopkins	616 Madison Ave.	New York City
1910—Dr. Thomas Hubbard	515 Nicholas Bldg.	Toledo, Ohio
1915—Dr. J. M. Ingersoll	1021 Prospect Ave.	Cleveland, Ohio
1890—Dr. Frederick L. Jack	215 Beacon St.	Boston, Mass.
1891—Dr. Walter B. Johnson	170 Broadway	Paterson, N. J.
1916—Dr. Isaac H. Jones	Air Service Division, S. G. O., Sixth and B. Sts.	Washington, D. C.
1904—Dr. Richard Jordan	165 West 58th St.	New York, N. Y.
1903—Dr. Joseph A. Kenefick	103 East 55th St.	New York, N. Y.
1907—Dr. B. R. Kennon	201 Taylor Bldg.	Norfolk, Va.
1910—Dr. Philip D. Kerrison	58 West 56th St.	New York, N. Y.
1916—Dr. Albert F. Koetter	303 Humboldt Bldg.	St. Louis, Mo.
1894—Dr. George A. Leland	354 Commonwealth Ave.	Boston, Mass.
1898—Dr. John C. Lester	616 Madison Ave.	New York, N. Y.
1914—Dr. Eugene R. Lewis	1130 Main St.	Dubuque, Iowa
1895—Dr. Robert Lewis	48 West 40th St.	New York, N. Y.
1911—Dr. Hanau W. Loeb	537 N. Grand Ave.	St. Louis, Mo.
1904—Dr. James E. Logan	1208 Wyandotte St.	Kansas City, Mo.
1881—Dr. Francis B. Loring	1420 K St., N. W.	Washington, D. C.
1899—Dr. David B. Lovell	Rooms 407-408 State Mutual Building	Worcester, Mass.
1912—Dr. Stephen H. Lutz	284 Hancock St.	Brooklyn, N. Y.
1898—Dr. George B. McAuliffe	616 Madison Ave.	New York, N. Y.
1910—Dr. James F. McGaw	Bank & Loan Bldg.	Watertown, N. Y.
1897—Dr. James F. McKernon	62 West 52nd St.	New York, N. Y.
1912—Dr. O. A. M. McKimmie	1330 Mass. Ave. N. W.	Washington, D. C.
1874—Dr. Cyrus S. Merrill	27 South Hawk St.	Albany, N. Y.
1888—Dr. Henry L. Morse	112 Marlborough St.	Boston, Mass.
1911—Dr. Harris P. Mosher	828 Beacon St.	Boston, Mass.
1906—Dr. Willis B. Moulton	180 State St.	Portland, Me.
1891—Dr. Robert C. Myles	11 East 48th St.	New York, N. Y.
1903—Dr. Francis R. Packard	304 South 19th St.	Philadelphia, Pa.
1913—Dr. John R. Page	127 East 62d St.	New York, N. Y.
1913—Dr. Charles E. Perkins	125 West 82nd St.	New York, N. Y.
1903—Dr. Wendell C. Phillips	40 West 47th St.	New York, N. Y.
1906—Dr. Norval H. Pierce	22 E. Washington St.	Chicago, Ill.

1899—Dr. Edward M. Plummer	5 Adams St.	Charlestown, Mass.
1914—Dr. George H. Powers, Jr.	298 Marlborough St.	Boston, Mass.
1908—Dr. John B. Rae	247 West 70th St.	New York, N. Y.
1888—Dr. B. Alexander Randall	1717 Locust St.	Philadelphia, Pa.
1901—Dr. Henry O. Reik	506 Cathedral St.	Baltimore, Md.
1906—Dr. W. Scott Renner	341 Linwood Ave.	Buffalo, N. Y.
1901—Dr. George L. Richards	124 Franklin St.	Fall River, Mass.
1886—Dr. Huntington Richards		Concord, N. H.
1908—Dr. John D. Richards	8 East 54th St.	New York, N. Y.
1898—Dr. Charles W. Richardson	1317 Connecticut Ave.	Washington, D. C.
1884—Dr. Stephen O. Richey	732 17th St.	Washington, D. C.
1895—Dr. Henry W. Ring	185 Church St.	New Haven, Conn.
1896—Dr. Arthur W. de Roaldes	1328 Jackson Ave.	New Orleans, La.
1909—Dr. Walter Roberts	1732 Spruce St.	Philadelphia, Pa.
1906—Dr. William K. Rogers	188 East State St.	Columbus, Ohio
1875—Dr. John D. Rushmore	129 Montague St.	Brooklyn, N. Y.
1915—Dr. W. E. Sauer	201 Humboldt Bldg.	St. Louis, Mo.
1912—Dr. T. Laurence Saunders	45 West 50th St.	New York City
1889—Dr. Ralph W. Seiss	255 South 17th St.	Philadelphia, Pa.
1904—Dr. George E. Shambaugh	People's Gas Bldg.	Chicago, Ill.
1890—Dr. John B. Shapleigh	Grand & Washington Aves.	St. Louis, Mo.
1906—Dr. Warren S. Shattuck	160 Clinton St.	Brooklyn, N. Y.
1912—Dr. Burt R. Shurly	32 Adams Ave. W.	Detroit, Mich.
1906—Dr. E. Terry Smith	36 Pearl St.	Hartford, Conn.
1909—Dr. S. MacCuen Smith	1429 Spruce St.	Philadelphia, Pa.
1906—Dr. Sargent F. Snow	707 University Block	Syracuse, N. Y.
1909—Dr. Selden Spencer	2725 Washington Ave.	St. Louis, Mo.
1904—Dr. Franklin M. Stephens	19 West 54th St.	New York, N. Y.
1875—Dr. George T. Stevens	350 West 88th St.	New York, N. Y.
1910—Dr. Joseph A. Stucky	Fayette National Life Bldg.	Lexington, Ky.
1914—Dr. Edward Blair Sutphen	162 South St.	Morristown, N. J.
1886—Dr. Theron Y. Sutphen	999 Broad St.	Newark, N. J.
1901—Dr. Lewis H. Taylor	82 South Franklin St.	Wilkes Barre, Pa.
1912—Dr. J. J. Thomson	3 Park Ave.	Mt. Vernon, N. Y.
1906—Dr. Andrew Timberman	112 East Broad St.	Columbus, O.
1914—Dr. George L. Tobey	416 Marlborough St.	Boston, Mass.
1906—Dr. Ernest de Wolfe Wales	705 Hume Mansur Bldg.	Indianapolis, Ind.
1906—Dr. D. Harold Walker	390 Commonwealth Ave.	Boston, Mass.
1873—Dr. David Webster	24 East 48th St.	New York, N. Y.
1906—Dr. Joseph A. White	200 East Franklin St.	Richmond, Va.
1891—Dr. Edward Wheelock	26 Gibbs St.	Rochester, N. Y.
1896—Dr. Fred Whiting	19 West 47th St.	New York, N. Y.
1912—Dr. John Gordon Wilson	104 S. Michigan Ave.	Chicago, Ill.
1899—Dr. Hiram Woods	812 Park Ave.	Baltimore, Md.

HONORARY MEMBERS
(Deceased)

Dr. E. H. Clarke
Dr. Edw. L. Holmes
Dr. Herman Knapp
Dr. A. F. Mayer
Dr. E. Williams

MEMBERS
(Deceased)

Dr. Frank W. Abbott
Dr. John L. Adams
Dr. C. R. Agnew
Dr. W. F. Akin
Dr. H. P. Allen
Dr. Edwin W. Bartlett
Dr. Charles H. Burnett
Dr. John P. Davidson
Dr. J. H. Dix
Dr. E. Dwyer
Dr. E. P. Ely
Dr. Edward Fridenberg
Dr. Blancome E. Fryer
Dr. John Green
Dr. Emil Gruening
Dr. Neil J. Hepburn
Dr. James Hewitt
Dr. Edgar M. Holmes
Dr. Gordon King
Dr. Charles J. Kipp
Dr. D. Braden Kyle
Dr. J. W. Lawton
Dr. W. S. Little
Dr. C. J. Lundy
Dr. G. Hudson-Makuen
Dr. Read J. McKay
Dr. Horace J. Miller
Dr. W. W. Moreland
Dr. James E. H. Nichols
Dr. Henry D. Noyes
Dr. J. F. Noyes
Dr. Oren D. Pomeroy
Dr. Barton H. Potts
Dr. Wm. Rankin, Jr.
Dr. J. M. Ray
Dr. Charles E. Rider
Dr. F. W. Ring
Dr. D. B. St. John Roosa
Dr. Wm. W. Seely
Dr. Henry L. Shaw
Dr. Edmund D. Spear
Dr. Frank Sprague
Dr. Samuel B. St. John
Dr. George Strawbridge
Dr. William Thompson
Dr. Robert Tilley
Dr. J. J. B. Vermyne
Dr. Frederick M. Wilson

THE AMERICAN OTOLOGICAL SOCIETY.

The 51st Annual Meeting of the American Otological Society was held at the Hotel Chelsea, Atlantic City, N. J., May 28-29, 1918.

The following members and guests were registered during the meeting:

Members:

John F. Barnhill, Indianapolis, Ind.
T. Passmore Berens, New York City.
H. S. Birkett, Montreal, Canada.
J. H. Bryan, Washington, D. C.
Ernest U. Buckman, Wilkes Barre, Pa.
Ralph Butler, Philadelphia, Pa.
Don M. Campbell, Detroit, Mich.
Cornelius G. Coakley, New York City.
Gerhard H. Cocks, New York City.
J. Frank Crouch, Baltimore, Md.
E. W. Day, Pittsburgh, Pa.
L. W. Dean, Iowa City, Iowa.
Edw. B. Dench, New York City.
Wells P. Eagleton, Newark, N. J.
Francis P. Emerson, Boston, Mass.
Thos. H. Halsted, Syracuse, N. Y.
Christian R. Holmes, Cincinnati, Ohio.
Edgar M. Holmes, Boston, Mass.
Frank T. Hopkins, New York City.
J. M. Ingersoll, Cleveland, Ohio.
Frederick L. Jack, Boston, Mass.
Walter B. Johnson, Paterson, N. J.
Isaac H. Jones, Philadelphia, Pa.
Philip D. Kerrison, New York City.
Eugene R. Lewis, Dubuque, Iowa.
Robert Lewis, New York City.
Hanau W. Loeb, St. Louis, Mo.

Stephen H. Lutz, Brooklyn, N. Y.
Robert C. Myles, New York City.
James F. McCaw, Watertown, N. Y.
George B. McAuliffe, New York City.
John R. Page, New York City.
Chas. E. Perkins, New York City.
Norval H. Pierce, Chicago, Ill.
Geo. H. Powers, Boston, Mass.
B. Alexander Randall, Philadelphia, Pa.
Geo. L. Richards, Fall River, Mass.
Chas. W. Richardson, Washington, D. C.
W. Scott Renner, Buffalo, N. Y.
W. E. Sauer, St. Louis, Mo.
Geo. E. Shambaugh, Chicago, Ill.
S. MacCuen Smith, Philadelphia, Pa.
Selden Spencer, St. Louis, Mo.
J. A. Stucky, Lexington, Ky.
E. Blair Sutphen, Morristown, N. J.
Lewis H. Taylor, Wilkes Barre, Pa.
J. J. Thomson, Mount Vernon, N. Y.
Geo. L. Tobey, Boston, Mass.
Jos. A. White, Richmond, Va.

Guests:

George M. Case, Elmira, N. Y.
H. W. Lyman, St. Louis, Mo.
R. C. Lynch, New Orleans, La.
T. C. Lyster, Washington, D. C.
Wm. W. Pearson, Des Moines, Iowa.
C. M. Robertson, Chicago, Ill.
Geo. T. Ross, Montreal, Canada.
J. J. Ryan, New Orleans, La.

The following members presented excuses for absence:

Dr. A. F. Koetter, St. Louis, Mo.
Dr. N. D. Harvey, Providence, R. I.
Dr. W. K. Rogers, Columbus, Ohio.
Dr. Franklin M. Stephen, New York City.

MINUTES.

The Executive Session was held at 2:00 P. M., Tuesday, May 28, 1918. President Norval H. Pierce in the Chair.

The minutes of the last meeting were read by the Secretary and approved as read.

The name of Dr. Charles M. Robertson, of Chicago, was proposed for membership by Dr. L. W. Dean, of Iowa City, Iowa, and seconded by Dr. Joseph H. Bryan, of Washington, D. C.

The Secretary then read the following report for 1917-18 and motion was made and carried that the report be accepted and spread upon the records:

The Fiftieth Annual meeting of the American Otological Society was held at the Hotel Chelsea, Atlantic City, N. J., May 29-30, 1917.

The occasion was celebrated by a Jubilee banquet on the evening of the 29th. Dr. Robert C. Myles officiated as toastmaster. Addresses were given by Drs. E. B. Dench, B. Alexander Randall, Geo. E. Shambaugh and Geo. T. Stevens.

The Secretary has compiled from the Transactions of the American Otological Society a list of the officers from the foundation of the Society to the present date. He suggests that this list appear each year in the Transactions, together with a list of the members of the Society.

Since the last annual meeting the Secretary has carried out the instructions of the Society and has had the new constitution and bylaws printed in pamphlet form and a copy mailed to each member of the Society.

At the last annual meeting motion was made and carried to raise a fund by voluntary subscription from the members to be sent to our esteemed fellow member, Col. H. S. Birkett, who has been serving with the Canadian troops in France since the beginning of the war, the fund to be used by him to further his work. The secretary is pleased to report that the sum of $300 was contributed to this fund by 65 members and was forwarded to Col. Birkett on Dec. 17, 1917.

It has seemed appropriate to the secretary to report and make a matter of record the services which the members of this society have been rendering the government in the work of organizing and carrying on the war. The replies from a questionnaire sent out by the secretary show that 30 of our members are serving with commissions in the Medical Reserve Corps and that 49 other members have been serving without commissions or remuneration, chiefly in assisting in the work of the various medical boards. This list is, of course, somewhat incomplete owing to the failure of some of the members to respond to the questionnaire, also to changes in rank and duties. When it is remembered that this is the senior Otological Society in this country and that its membership is made up largely of the older members of the profession, many of whom have passed the age when it is feasible for them to assume extra work of any sort, this showing is one of which the Society may well be proud.

THOSE SERVING WITH COMMISSIONS ARE:

DR. T. P. BERENS, Major, M. R. C.
Base Hospital No. 1.

DR. HERBERT S. BIRKETT, Colonel.
Canadian Medical Service. Originated, organized and commanded the McGill University Hospital for overseas service in France.

DR. J. H. BRYAN, Major, M. R. C.

DR. GERHARD H. COCKS, Captain, M. R. C.

DR. E. A. CROCKETT, Major, M. R. C.
Served with American Red Cross Commission to Serbia, 1917. Italian Commission 1918-1919.

DR. E. W. DAY, Major, M. R. C.
Chief of Division of Head Surgery, Camp Lee.

DR. E. B. DENCH, Major, M. R. C.
Consulting Oto-Laryngologist at Camp Upton. Also doing work at Columbia General Army Hospital, and giving courses on the relations of the ear to nervous diseases and injury, before neurological surgical classes.

DR. WELLS P. EAGLETON, Major, M. R. C.
Base Hospital, Camp Dix, N. J.

DR. FRANCIS P. EMERSON, Major, M. R. C.
Camp Lee, Va.

DR. M. A. GOLDSTEIN, Major, M. R. C.
Awaiting orders in connection with work for re-education of the deaf and for speech correction of disabled soldiers.

DR. THOMAS J. HARRIS, Major, M. R. C.
Charge of the Army Nose, Throat and Ear School, Fort Oglethorpe, Ga.

DR. W. H. HASKIN, Lieutenant Colonel, M. R. C.
Stationed at West Point.

DR. N. D. HARVEY, Major, M. R. C.
Surgeon of regiment destined to perform duty in Rhode Island.

DR. R. J. HELD, Captain, M. R. C.
Base Hospital, Camp Upton, N. Y.

DR. CHRISTIAN R. HOLMES, Major, M. R. C.
Has charge of head surgery at Camp Sherman, Chillocothe, Ohio.

DR. ERASTUS EUGENE HOLT, Lieutenant, M. R. C.
Medical aide to the governor of Maine in forming Medical Advisory Boards of the state.

DR. J. M. INGERSOLL, Major, M. R. C.
In charge of examination of aviators, Lake Side Hospital, April 30, 1918. Since then in charge of Oto-Laryngological Department, U. S. Army General Hospital No. 11, Cape May, N. J.

DR. ISAAC H. JONES, Lieutenant Colonel, M. C. N. A.
Been doing service in this country and abroad in connection with examinations for aviation.

DR. B. R. KENNON, Major, M. R. C.
Opthalmologist, Base Hospital No. 53, Camp Hancock, Ga.

DR. EUGENE R. LEWIS, Major, M. R. C.
Otologic member of Medical Research Board, of Aviation Section, stationed at Washington, D. C. Detailed to Medical Research Board Laboratory, Hazelhurst Field, Mineola, N. Y.

DR. H. W. LOEB, Major, M. R. C.
Assigned to literary duty.

DR. JAMES F. McKERNON, Major, M. R. C.
Serving in France with U. S. Army Base Hospital No. 8.

DR. HARRIS P. MOSHER, Lieutenant Colonel, M. R. C.
Surgeon General's Office, Washington, D. C.

DR. FRANCIS R. PACKARD, Captain, M. R. C.
Serving in France, with Base Hospital No. 10.

DR. NORVAL H. PIERCE, Major, M. R. C.
Chief of Division of Surgery of Head, Camp Grant, Ill.

DR. JOHN B. RAE, Captain, M. R. C.
Serving in France, with U. S. Army Base Hospital No. 8.

DR. H. O. REIK, Major, M. R. C.
Otologist at Base Hospital, Camp Sheridan, Ala.

DR. CHARLES W. RICHARDSON, Lieutenant Colonel, M. R. C.
Direction of defects of hearing and speech, in the Division of Physical Reconstruction.

DR. S. MacCUEN SMITH, Major, M. R. C.
Was assigned to duty at Camp Meade but on account of illness was detached and since has been acting in advisory capacity in connection with Surgeon General's Office.

DR. GEORGE E. SHAMBAUGH, Major, M. R. C.
Stationed at Camp Grant, Rockford, Ill.

DR. BURT R. SHURLY, Lieutenant Colonel, M. R. C.
Serving abroad.

THOSE SERVING WITHOUT COMMISSIONS.

DR. **JOSEPH A. ANDREWS**, has offered his services to the war department, but has not been called. Has accepted a position as a volunteer worker in the International Grenfeld Medical Mission, Labrador and Newfoundland.

DR. **GORHAM BACON**, serving on medical advisory boards.

DR. **JOHN F. BARNHILL**, has been examining aviators.

DR. **ALEXANDER GRAHAM BELL**, member reconstruction service of the Industrial Union for the Deaf. Chairman advisory committee of the board of directors of the American association to promote the teaching of speech to the deaf, etc.

DR. **CLARENCE J. BLAKE**, at work on the study of war deafness and rehabilitation.

DR. **FRANK J. BLODGETT**, serving on Medical Advisory Board.

DR. **W. C. BRAISLIN**, serving on Medical Advisory Board.

DR. **JAMES B. CLEMENS**, member and secretary of New York state committee, medical section, of the Council of National Defense.

DR. **C. G. COAKLEY**, chairman Medical Advisory Board, district No. 2, New York city.

DR. **CHARLES M. COX**, serving on Medical Advisory Board.

DR. **L. W. DEAN**, serving on Medical Advisory Board, also on State Medical Council of National Defense. Has been told by the surgeon general's office not to enlist because of his teaching work.

DR. **JOHN DUNN**, examining aviators.

DR. **J. B. EMERSON**, serving on Medical Advisory Board.

DR. **T. H. HALSTED**, surgeon in the charge of aviation examining unit, Syracuse, N. Y. Member of Medical Advisory Board.

DR. **HERBERT HARLAN**, serving on Medical Advisory Board.

DR. **DAVID HARROWER**, serving on Medical Advisory Board.

DR. **FRANK TUCKER HOPKINS**, serving on Medical Advisory Board.

DR. **THOMAS HUBBARD**, serving on Medical Advisory Board.

DR. **FREDERICK L. JACK**, serving on Exemption Board, Back Bay Station, Boston, Mass.

DR. **WALTER B. JOHNSON**, district chairman Council of National Defense. Serving on Medical Advisory Board. General manager of Paterson, N. J. Chapter of American Red Cross.

DR. **RICHARD JORDAN**, member of medical committee of the Soldiers' Aid, 17th congressional district.

DR. **PHILIP D. KERRISON**, serving on Medical Advisory Board; also examining recruits for aviation.

DR. **A. F. KOETTER**, debarred from commission because of physical disability. Has been examining aviators; also doing exemption board work.

DR. **STEPHEN H. LUTZ**, serving on Medical Advisory Board.

DR. **JAMES F. McCAW**, serving on Medical Advisory Board.

DR. **CYRUS S. MERRILL**, serving on Medical Advisory Board.

DR. **JOSEPH RANDOLPH PAGE**, examining recruits for aviation corps and serving on Medical Advisory Board.

DR. **WENDELL C. PHILLIPS**, advisory service.

DR. **B. ALEXANDER RANDALL**, teaching three graduate groups of U. S. Medical Reserve men in neural surgery, University of Pennsylvania.

DR. **M. SCOTT RENNER**, serving on Medical Advisory Board.

DR. GEORGE L. RICHARDS, medical officer district board No. 6, selective service, Massachusetts.
DR. HENRY W. RING, serving on local exemption boards.
DR. W. K. ROGERS, no commission because of age limit. Been doing work in the examination of recruits.
DR. J. D. RUSHMORE, government work at St. Peter's Hospital, Brooklyn, N. Y.
DR. T. L. SAUNDERS, serving on Medical Advisory Boards
DR. J. B. SHAPLEIGH, has been requested by surgeon general's office not to accept military service because of teaching work.
DR. SARGENT F. SNOW, does not hold commission because of age limit. Serving on aviation board and Medical Advisory Board. Also making strenuous efforts to increase agricultural production.
DR. FRANKLIN M. STEPHENS, serving on local exemption board.
DR. J. A. STUCKEY, no commission on account of age limit. Has been doing a great deal of work, especially filling the role of lecturer as one of the 4-minute men.
DR. E. BLAIR SUTPHEN, serving on local exemption board and on advisory board.
DR. T. Y. SUTPHEN, enrolled in volunteer service corps, in January, 1918. Not yet called for duty.
DR. E. TERRY SMITH, serving on Medical Advisory Board, Hartford, Conn.
DR. LEWIS H. TAYLOR, member of the state committee, Council of National Defense.
DR. J. J. THOMPSON, operating at General Hospital No. 1, New York city.
DR. ANDREW TIMBERMAN, serving on Medical Advisory Board.
DR. D. H. WALKER, serving on Medical Advisory Board.
DR. JOSEPH A. WHITE, does not hold commission because of age limit. Has charge of aviation examining unit; also chairman of board of governors, medical section, State Council of Defense; and serving on Medical Advisory Board.
DR. HIRAM WOODS, serving on Medical Advisory Board.

TREASURER'S REPORT.

Balance turned over from previous Treasurer....	$1,045.97
Receipt of delinquent assessments.....	30.00
	$1,075.97
Expenditures as per vouchers 1 to 10 inclusive....	637.31
Balance on hand May 28, 1918.....	$ 438.66

The Chair appointed Drs. W. H. Loeb and F. P. Emerson auditing committee. Committee reported the statement of Treasurer was correct. Report was accepted.

The following recommendations by the Council were received and acted upon:

That a change be made in Article II, Section 2 of the Bylaws to read as follows:

Sec. 2.—The Council shall consist of seven members: The President, Vice-President and Secretary, ex-officio, each retiring president—who shall be a member for two years after his term of office as President has expired—and two other members who shall be elected by the Society.

The elected members shall retire in order of their election, one each year.

That the names of Drs. J. W. Downey, of Baltimore, Md., and E. P. Fowler, of New York City, be recommended for membership. The Secretary was instructed to cast the ballot of the Society for their election.

That the name of Dr. S. J. Kopetzky, of New York City, be carried over. Motion made that the recommendation of the Council be confirmed. Motion seconded and carried.

That each member of the society be assessed $5.00, to defray expenses for the ensuing year. Recommendation of the Council confirmed.

The following resolution as proposed by the Council was read and a motion made and carried that the resolution be adopted and a copy spread upon the minutes:

RESOLVED, That the American Otological Society, assembled at Atlantic City, New Jersey, unanimously indorses the plan for a new Army Medical Museum, and request that therein be provided adequate space for the proper care and the efficient study of the material being furnished from the battle fronts of Europe.

The inestimable value of this material for immediate and future study and research cannot be appreciated even at the present writing. We strongly urge upon Congress most liberal provisions for this work. Military medicine and science has made such stupendous advances during the present warfare that it seems that for the maintenance of this progress adequate space should be forthcoming for proper study and continuance of this scientific work.

There is no place where this work can be so adequately conducted as in Washington. We therefore heartily approve the proposed plan, and urge most liberal appropriation for its consummation.

Council recommended that for Governors of the American College of Surgeons the men now filling these positions be continued. Recommendation of the Council confirmed.

The Council made the following recommendation for officers for the coming year:

President—Dr. Ewing W. Day, Pittsburgh, Pa.

Vice-President—Dr. Robert Lewis, New York City.

Secretary-Treasurer—Dr. Geo. E. Shambaugh, Chicago.

Motion was made and carried that the recommendation of the Council be confirmed and the Secretary be instructed to cast one ballot for the officers recommended.

The Council recommended that Dr. B. Alexander Randall be appointed official necrologist of the Society. Motion was made and carried that the recommendation of the Council be confirmed.

The Council for the ensuing year is made up as follows:

Dr. Ewing W. Day (President);

Dr. Robert Lewis (Vice-President);

Dr. Geo. E. Shambaugh (Secretary);

Dr. Christian R. Holmes, Dr. Norval H. Pierce (Retiring Presidents);

Dr. E. B. Dench, Dr. Fred'k L. Jack (Elected by the Society).

NEW BUSINESS.

The following resolution was presented:

WHEREAS, In accordance with Army Regulations Major General William C. Gorgas, now Surgeon General of the United States Army, will reach the prescribed age for retirement in October, 1918; and

WHEREAS, By virtue of his scientific attainments and his statesmanlike vision, he has proven himself eminently qualified not only to meet the extraordinary exigencies of

the present situation, but also to plan with wisdom and foresight the further development of the Army; and

WHEREAS, By his recognition of the important part the various specialties in medicine have accomplished in relieving the suffering and reclaiming the afflicted, he has made it possible, so far as is consistent with Military Duties, to utilize physicians specially trained in Oto-Laryngology, now enrolled in the Medical Reserve Corps, to render medical service in the fields in which they are best qualified;

RESOLVED, That it is the sense of the American Otological Society that it would be for the best interest of the Nation if General Gorgas were continued in his present office as Surgeon General; and

BE IT FURTHER RESOLVED, That this expression of confidence in General Gorgas be communicated to the President of the United States.

Motion was made and carried that the above resolution be accepted and that the Secretary transmit a copy to the President of the United States.

Motion was made and carried that the names of alien enemies be dropped from the roll of honorary members of the society.

The following report of the Activities of the Sub-Committee on Oto-Laryngology of the Surgical Specialties, of the General Medical Board, of the Council of National Defense, was presented:

REPORT OF THE ACTIVITIES OF THE SUB-COMMITTEE ON OTO-LARYNGOLOGY OF THE SURGICAL SPECIALTIES OF THE GENERAL MEDICAL BOARD OF THE COUNCIL OF NATIONAL DEFENSE TO THE CONSTITUTIONAL SOCIETY BY WHICH IT WAS APPOINTED.

At the request of the Medical Section of the Council of National Defense, the Presidents of the American Otological Society, the American Laryngological Association and the American Laryngological, Rhinological and Otological Society appointed Doctors Charles W. Richardson, Burt R. Shurly and Harris P. Mosher a committee to formulate a scheme by which the membership of these societies and their colleagues throughout the country practicing these specialties, but not affiliated with these societies could be most advantageously utilized in case the United States became involved in the general war then prevailing in Europe.

The committee met in Washington, D. C., March 31, 1917 and April 1, 1917. At this meeting, Dr. Charles W. Richardson was elected chairman. The committee after due deliberation prepared and formulated a series of suggestions for consideration of the Medical Section. Before the tentative plans were finally acted upon a conference was held March 31, with Major Robert E. Noble of the Medical Corps, U. S. A., and Medical Director Holcomb of the Navy, in order that they might guide us in our action and offer suggestions. These medical officers gave the committee advice and offered many valuable suggestions. The suggestions as adopted were presented to Dr. F. F. Simpson, chief of the Medical Section, National Council of Defense.

"Having been asked by the Council of National Defense to suggest in which way the nose, throat and ear specialists of the societies mentioned can be of use to

the Army and Navy Medical Corps, we feel that we can suggest the following:

We recommend that all the members of the American Otological Society, the American Laryngological Association and the American Laryngological, Rhinological and Otological Society be requested to become members of the Medical Reserve Corps of the Army and Navy, or of the Officers Reserve.

In the first place, the members of these societies could examine recruits for the aviation service, in testing the condition of their labyrinths.

In the second place, we could be of service in examining the upper air track of recruits, especially in cases of hoarseness or other suspicious conditions which might evidence the possibility of tuberculosis.

In the third place, we could be of service in examining all recruits in whom there was a suspicion of impairment of the hearing, or in which there was any evidence or suspicion of the infection of the middle ear, either acute or chronic. We recognize the importance of excluding chronic suppurative ears, from the experience of the British Army.

We could be of service in the organization of a base hospital for the treatment of cases of injuries and diseases of the eye, ear, nose and throat at the base of military operations or elsewhere.

The younger man or junior is the physician under thirty-five years of age, and the consultant or senior is the physician over thirty-five years.

It is advised that the younger men be utilized for active service in the base or other hospitals, and that the older men be utilized as consultants for one or more base hospitals, or a group of neighboring hospitals.

It is advised that a list of the Naval and Base Hospitals, and Naval Training Stations be obtained, and a list made of the consulting specialists. This list is to be placed in the hands of the Army and Navy officials in order that in case of need the required specialists may

be assigned to the various hospitals. The names of these specialists are to be chosen by a committee from the three special societies represented by this committee.

We should like to call attention to the necessity of testing the hearing of men in military service in order to ascertain the type of impairment of hearing that will exclude men from certain forms of service, yet permit them to engage in other forms; and to formulate and publish these tests for the use of the consulting military throat and ear specialists of the country.

We recommend that men furloughed from the front, having affections of the nose, throat and ear, be referred to some distinct hospital and some designated physician in connection with that hospital, in order that the physician may keep in touch with the soldier or sailor until he is sent back to the line of service."

CHARLES W. RICHARDSON,
Representing the American Otological Society.

BURT R. SHURLY,
Representing the American Laryngological Association.

HARRIS P. MOSHER,
Representing the American Laryngological, Rhinological and Otological Society.

On March 26, due notification of the membership of the committee, and that a meeting was to be held in Washington, was forwarded to Dr. F. F. Simpson, chief of Medical Section, National Council of Defense, which was acknowledged March 29, 1917.

COUNCIL OF NATIONAL DEFENSE.
WASHINGTON.

March 29, 1917.

Dr. Charles W. Richardson.
Washington, D. C.

My dear Dr. Richardson:—

I am very glad to have your letter of March 27, giving me the names of representatives of your three

special associations and will be glad to have the further information to which you refer.

Very sincerely yours,

(Signed) F. F. Simpson,
Chief Medical Section
Council of National Defense.

Acknowledgement was also received of the report of the committee by Dr. F. F. Simpson, and it was stated that your committee would be further advised. At the meetings of the constituent societies in Atlantic City, May 29, to June 2, 1917, reports were made by your committee. At these meetings your committee was requested to consult the Surgeon Generals of the Army and Navy, for the purpose of requesting that the members of these societies that became members of the Officers Reserve Corps be employed, so far as possible in the line of their specialty.

That the committee appointed to meet the Council of National Defense be empowered to consult the Surgeon Generals of the Army and Navy, for the purpose of requesting that the Medical Officers of the Officers' Reserve Corps of this Society be employed, so far as possible, in the line of their specialty, and that it be suggested to them the advisability of establishing one or more base hospitals devoted to injuries of the head and air passages and diseases of the eye, ear, nose and throat, acquired in service; and also that this committee be empowered to take up any question that the Surgeon Generals of the Army and Navy or that they may suggest, for the interests of the members of this society, in connection with the present war, and that the attention of the Surgeon Generals of the Army and Navy be called to the action of the joint meeting in regard to the examination of aviators and the employment of hospitals in their staffs to this purpose.

Shortly thereafter a conference was held with the Surgeon General of the Army, and he received most kindly the suggestion of the society as embodied in the above resolution. He stated that he had under advisement the appointment of Major Theodore F. Lyster, Medical Corps, U. S. A., as an advisor to the committee, through his agency bringing the committee's activities in closer relation to the U. S. Medical Corps' activities. This action was promptly taken, and your committee began soon to realize the value of Major Lyster's guiding hand, and his valuable organizing ability. Your chairman also consulted the Surgeon General of the Navy. The Surgeon General of the Navy appreciated greatly the objects and desire of your committee, but acknowledged on account of the different features in the two services that he would not be able to employ us to the same degree of advantage as the other branch of the service. He readily acquiesced in the appointment of a member of the Medical Corps of the Navy as an advisor to the committee. The appointee was Surgeon G. E. Trible.

On June 21, information was given your committee that it present a request before the meeting of the General Medical Board of the Council of National Defense to be held June 22, 1917, to be created as a sub-committee on oto-laryngology of the Surgical Specialties of the General Medical Board of the Council of National Defense. The plea for this action was presented at the meeting June 22.

Washington, D. C.,
June 22, 1917.

Chairman of the General Medical Board,
Council of National Defense,
Washington, D. C.

Dear Sir:

The American Otological Society, the American Laryngological Association, the American Laryngological, Rhinological and Otological Society, and the Laryngological and Otological Section of the Amer-

ican Medical Association, containing a committee appointed by the three former societies, consisting of Dr. Charles W. Richardson of Washington, D. C., Dr. Harris P. Mosher of Boston and Dr. Burt R. Shurly of Detroit, wishes to continue its activities and represent them before the Council of National Defense and the Surgeon Generals of the Army and Navy. This committee had a meeting in April, 1917 at which a report was formulated and presented to the Chairman of the General Medical Board of the Council of National Defense.

We know that the members of the above mentioned societies will be pleased that the Council of National Defense has invited this committee to advise with them on this special and general work which the war has thrown upon the Medical Departments of the Army and Navy.

These societies have requested this committee to so far as is in the power of the War and Navy services to employ the members of these societies in the lines of their special field.

The committee has been encouraged to believe that such disposition will be made of these men so far as is possible. In brief, some of the questions for immediate action before this committee are as follows:

The establishment of special hospitals for treatment of wounds and diseases of the eye, ear, nose and throat.

The designation of men for the examination of aviation recruits, suggested by this committee and which is being thoroughly carried out.

In our original report we advised that men be selected for consulting and active duty in base, eye, ear, throat and nose hospitals, and in connection with general hospitals, and that these men furnished through this committee, in action with the personnel medical officers of the Army and Navy.

If it is the pleasure of the Medical Board of the Council of National Defense to appoint this commit-

tee as a sub-committee on the ear, nose and throat, it stands ready to devote its services to whatever duty and in whatever form the General Committee may designate.

Respectfully submitted,

(Signed) CHARLES W. RICHARDSON,
Chairman.

Your chairman appeared before the executive committee in due course in elaborating the necessities of the appointment of your committee as a subcommittee of the Surgical Specialties of the General Medical Board, Council of National Defense. In a future conference with the Chairman of the Executive Committee, it was thought advisable to enlarge your committee, in the sub-committee of oto-laryngology, by the addition of Major Theodore F. Lyster and Surgeon G. E. Trible. This action was taken. The sub-committee of oto-laryngology of the Surgical Specialties of the General Medical Board of the Council of National Defense as appointed by the chairman of the Executive Committee, Dr. Franklin Martin, consisted of the following membership: Dr. Charles W. Richardson, Chairman, Dr. Harris P. Mosher, Dr. Burt R. Shurly, Major Theodore F. Lyster, U. S. A., and Surgeon G. E. Trible, U. S. N.

The sub-committee of oto-laryngology was instructed by Chairman Franklin Martin, June 22, 1917, that in due course the sub-committee would receive official sanction for its work—in the meantime—until such official sanction was forthcoming, it should begin its activities.

As war had been declared against Germany, and the United States Government was preparing to augment its fighting force through volunteer enlistment and conscription, it became necessary to furnish a large number of medical men to examine recruits and look after the welfare of these men while being prepared for service, and later on the firing line. As our specialties had been partly assured that their services would be utilized along

the line of their special field, in so far as it was possible under military medical organization, it became the object of your committee to enlist the support of oto-laryngologists for military medical service. The first object of your committee therefore was the listing of all men known as throat, nose and ear specialists in the United States. Through the use of various directories, 5,600 names were listed. This was completed July 6, 1917.

The second object was the formulating of a questionnaire to be sent to each individual listed. The sub-committee on ophthalmology had already prepared such a questionnaire and it formed the basis of the one which we adopted with slight modification, July 3, 1917. (Exhibit 1.)

The third object was the enlisting of an office force of volunteer typists to index the list of 5,600 names into suitable books arranged alphabetically as to names, and, arranged alphabetically according to states. (Exhibit 2).

The fourth object was the enlisting of an adequate volunteer force to address and mail the questionnaire, and to dispose of the replies. The fifth object was the employment of a competent stenographer.

All of these objects were adequately met. The questionnaire was received on July 7th, by the committee. They were all in the hands of the Council of National Defense for mailing on July 9th.

The returned questionnaires were classified under the following heads. (Exhibit 3.)

It was found necessary in order to simplify the work and make it less arduous for the committee to prepare a set of "form" letters in reply to the returned questionnaire. The nature of the replies made this applicable in the great majority of cases. (Exhibits 4, 5, 6, 7 and 8.)

A large number of letters and questionnaires demanded and received individual answers.

The committee also found it expedient to form an advisory committee for the purpose of giving them information as to the standing of various individuals applying for ser-

vice and already members of the M. O. R. C., of whose professional special standing the committee had no personal knowledge. The selection was made of one advisor in each state, in the more populous states two. (Exhibit 9.)

To each of these advisors, as the circumstances arose a regular form letter was sent with the name of the individual about whom information was requested, as well as the classification to make. (Exhibit 10.)

Besides the index catalogue book which we have already submitted, each individual replying favorably as to service, M. R. C., and for future service was card indexed in two forms, viz.: 1. By a large card on which all information obtained by the questionnaire was noted. 2. Through a small card which was to serve as a record of the acceptances of commission, and subsequent medical army service. (Exhibits 11 and 12.)

Through the efforts of an able corps of volunteers this work was expeditiously and efficiently consummated.

This phase of our effort was practically completed by August 15, 1917.

Number of questionnaires	5,488
Replies	2,014
Unanswered	3,474
Replies grouped as follows:	
Ophthalmology	1,244
M. O. R. C.	171
Accept service	196
Within draft limit	40
Past age limit (unavailable)	158
Physically disqualified	167
Dependents	58

The furnishing of questionnaires, container and "franked" return envelopes, multigraphing "form" letters and the use of the "frank of the Council of National Defense, was furnished by the Council. The work incident to addressing, mailing and clerical was volunteer. The cards were furnished by the office of the Surgeon General. Other expenses were borne by your committee.

The sub-committee on Ophthalmology and Oto-laryngology found it expedient in the early period of their activities, as well as of strategic value, to combine their efforts. An informal meeting was held on July 7, 1917. At this meeting a general plan of co-operation was outlined. Consent was requested of the General Medical Board for the sub-committees to meet in joint session whenever they deemed it advisable, the two sub-committees to still maintain their individual identity. The request was duly sanctioned. At the same meeting the joint committee designated itself as the Head Surgical Committee. A letter was formulated to the Surgeon General entitled, "Establishment of Head Surgical Sections for Base Hospital Groups," to be presented to the Surgeon General by Major Lyster.

July 7, 1917.

From: The Sub-Committee on Ophthalmology and Oto-laryngology of the General Medical Board of the Council of National Defense.

To: Surgeon General Wm. C. Gorgas, U. S. A., Washington, D. C.

Subject: Establishment of Head Surgical Sections for Base Hospital Groups.

The Sub-Committees on Ophthalmology and Oto-laryngology, in a joint meeting with representatives from the Army and Navy, deem it advisable to call your attention to the enclosed informal resolution, with the following explanatory suggestions:

It is estimated that approximately twenty per cent. of the capacity of Base Hospital groups should be devoted to injuries or other affections involving the head. These cases can be brought to their proper section more expeditiously by direction from a common administrative head. Not only will the overhead administrative force be thus lessened, but also confusion and unnecessary details and loss of time in transferring from one section to another will be eliminated.

The elasticity of this method of handling permits its being applied to any institution, no matter what its size may be, from a hospital of several hundred to one of several thousand beds. In the smaller institutions the section would not be more than a ward. In a larger institution it would be practically a separate hospital.

When several Base Hospital groups are located in close proximity they should be combined as a greater Base Hospital group, so that the various sections, such as the Head Surgical Section, would be combined; only so much of the staff and equipment to be mobilized as is deemed necessary.

The Sub-Committees on Ophthalmology and Oto-laryngology believe that in order to make this unit complete a brain surgeon and an oral surgeon, with necessary staff, be a part of the Head Surgical Section, as these specialties are so closely related and interdependent. It is believed that Base Hospital groups so organized will not only add to their efficiency, but will insure their being administered for the best interest of the patients.

Respectfully submitted,

Sub-Committees on Ophthalmology
and Oto-laryngology.
W. H. WILMER, Chairman,
Sub-Committee on Ophthalmology.
JAMES BORDLEY, Chairman,
Sub-Committee on Oto-laryngology.
CHARLES W. RICHARDSON, Chairman.

It was also moved and approved that a resolution be drafted enlarging the Head Surgical Committee by the addition of a brain and oral surgeon. A letter was also submitted by the committee through Surgeon Trible of the Navy to the Surgeon of the Navy. "Recommendation as to the appointment of specialists in the Navy for War Service."

From: The Sub-Committees on Ophthalmology and Oto-laryngology of the Medical Section of the Council of National Defense.

To: Surgeon General, U. S. Navy.

Subject: Recommendation as to the appointment of Specialists in the Navy for War Service.

1. At a joint meeting of the Sub-Committee on Ophthalmology and Oto-laryngology of the Medical Section of the Council of National Defense, it was resolved to offer this recommendation to the Surgeon General of the Navy:

The Sub-Committees believe that the best interests of the Naval Medical Service and the welfare of the personnel are served by the detailing of one Ophthalmologist and one Oto-laryngologist to each of the large Naval Stations and Bases not provided with such specialists and the Sub-Committees tender their services to the Surgeon General for duty at sea or abroad if the occasion arises. The Sub-Committees are informed that the field in the Navy is necessarily somewhat limited and that the conditions prevailing in the Army and with the Red Cross are not duplicated in the Naval Service, where use must be made of specialists as individuals and not as members of organized hospital units. It is believed that with the facilities at the command of the Sub-Committees, qualified men can be found to accept service under the peculiar circumstances existing and the Sub-Committees freely offer their assistance as they feel that the efficiency of the medical administration is promoted by this action.

Attention is invited to the accompanying letter to the Surgeon General of the Army outlining a plea believed by the Sub-Committees to offer a practical solution of handling the larger percentage of head injuries received in the existing type of warfare. Since the conditions under which a large naval action may take

place are constantly varying, the Sub-Committees do not feel competent to suggest a plan of procedure which because of diverse conditions might not be feasible.

The action of the Sub-Committee on July 7th in requesting the Surgeon General to form and recognize the Surgical Head Unit in the United States Army Medical Service was the most signal and important step that had been taken. Through the able assistance of Major Lyster the request was well received by the Surgeon General and a few days later was approved. Dr. W. H. Wilmer was designated as Chairman of the section of Surgery of the Head.

On Aug. 15, Major Mosher of the Oto-laryngological subcommittee was assigned to Major Lyster's office. Dr. V. P. Blair was made a member of the committee, representing the oral-plastic sub-section and assigned to the Oto-laryngological Sub-Committee. Dr. Bagley was made a member of the committee, representing the sub-section of brain surgery and assigned to the Ophthalmologic sub-committee.

With the authorized creation of the section of Surgery of the Head, Major Mosher, Major Black, Major Blair and Captain Bagley were assigned to this section as representing the four sub-sections of which the section was composed, with Lieut.-Col. Lyster as the officer in chief.

From time to time various important questions as to organization, ways and means and various other timely subjects were discussed at the numerous meetings, held by the joint committees. The subject of the re-organization of the committees came before several of the meetings and was most acutely discussed. After mature deliberation, it was decided to defer such action to a later day.

On August 15, your chairman was notified by Dr. Franklin Martin, chairman, General Medical Board, Council of National Defense, that the sub-committee on Otology, Rhinology and Laryngology had been formerly approved by the Council of National Defense.

August 15, 1917.

From: Dr. Franklin Martin

To: Dr. Charles W. Richardson, 1317 Connecticut Ave., Washington, D. C.

Subject: Appointment to Committee on Otology, Rhinology and Laryngology.

1. The Sub-Committee on Otology, Rhinology and Laryngology has been formally approved by the Council of National Defense and the enclosed notification sent to the various members of your committee. This is a Sub-Committee of the Committee on Surgical Specialties of the General Medical Board.

Yours very truly,

FRANKLIN MARTIN,
Chairman, General Medical Board.

On August 15, the Head Surgical Committee was informed through Lieut. Col. Theodore F. Lyster, that the Surgeon General had suggested that he would look with favor on the preparation of plans and suggestions, from the committee for the formation of a one thousand bed hospital for the surgical head section on the Western Front abroad. Sub-committees on construction, personnel, equipment and shops were immediately formed. After due deliberation and many consultations the completed plans, with costs were placed in the hands of the Surgeon General. Favorable action was taken. (Exhibit 13.)

During all this period the committee's activities were being more and more closely aligned into the activities of the Section of Surgery of the Head of the Surgeon General's office.

Other activities during this period and subsequent consisted of:

1. The visit of members of the sub-section to various cities, Cleveland, Detroit, Chicago, St. Louis and Cincinnati, August 21-26, under special order to make addresses to the oto-laryngologists in those cities in order to arouse their enthusiasm and gain recruits to the Army Medical Service.

2. The standardization of oto-laryngological instruments.

3. The revision of hearing requirements for entrance to the Army.

4. The assembling of tests for malingerers.

5. Efforts have been and are now being prosecuted to ascertain the best ear protectors for use in the service. These tests are being made at Indian Head and the Navy Yard in the City of Washington.

6. In conjunction with the sub-section of Ophthalmology the brain and plastic officers in the Section of Surgery of the Head, Surgeon General's office, under the direction of Major Mosher of this committee plans for a special hospital and dispensary building in the cantonments were completed.

7. Reports have also been sent out by this sub-committee through the secretaries of the National Societies which they represent, to all their membership, outlining the activities of this sub-committee.

8. Through the presence of Major Harris P. Mosher, in the office of the Surgeon General, and latterly through Major Charles W. Richardson, we have been enabled to suggest to the chief of the personnel bureau the appropriate grade to be assigned to various candidates for service in M. R. C.

9. Through the institution of our advisory committee we have been able to obtain an accurate tab on the professional qualifications and character of each candidate for service in M. R. C.

10. We have also made the assignments in oto-laryngology in the base hospital in the cantonments and National Guard Camps.

11. In preparation is a roster of the men to be assigned in oto-laryngology, in the base hospitals abroad.

12. A course of lectures at the cantonments by the chief of the oto-laryngologic staff was ordered; the subjects to be lectured upon were given, and the officer to deliver the lecture was designated at each cantonment. A review of the literature was made. A list of books for the library was prepared.

13. The Sub-Committee has had Major Hanau W. Loeb of St. Louis, editor of the Annals of Otology, Laryngology

and Rhinology, assigned temporarily for duty in the Surgeon General's office, in order to prepare the manuscript for a war manual of oto-laryngology.

14. Through the activities of this sub-committee a certain legislative act was so shaped as not to invalidate the right and authority of the Surgeon Generals of the Army and Navy to the reconstruction, re-education and rehabilitation of the soldier and sailor in these arms of the service.

15. On October 24, Major Harris P. Mosher was ordered abroad on an inspection tour with Lieut. Col. Theodore F. Lyster. On October 25, Major Charles W. Richardson was ordered to temporary duty, in the office of the Surgeon General to occupy the desk left vacant by Major Mosher.

16. On September 27, Major Burt R. Shurly resigned as a member of the committee on account of going abroad with his hospital unit.

17. On October 20, Major Joseph H. Bryan was nominated by the Council of the American Laryngological Association to the vacancy. On November 15, Dr. Franklin Martin as chairman of the Executive Committee approved the appointment.

The Sub-Committee made reports from time to time to the General Medical Board of its activities, at times written and other times verbal.

During the latter part of September or early in October an important memorandum was issued by the Surgeon General designated "Recognition of Sections Representing Specialists." In this memorandum appears the following sentence, "the first step in carrying out this policy was the grouping of those specially qualified into a section of Surgery of the Head." It is followed by the statement that, "the older division of army medical work into the two divisions of surgery and medicine is suspended by the following grouping." The eight sections are then named.

RECOGNITION OF SECTIONS REPRESENTING SPECIALISTS.

The sudden expansion of the Medical Corps of the Army by the incorporation of civilian physicians

forces the consideration of new questions of policy. Civilian physicians of the largest experience are for the most part specialists. The problem is, how to give the army the benefit of their special training and at the same time give them the necessary military instruction to make them effective from the military standpoint. Apart from the medical department, specialism has long been the rule in the other branches of the service. And in the medical department by the specializing of certain men, preventive medicine achieved some of its most notable advances.

In the beginning of the war it became the policy of this office to utilize the services of the specialist as far as possible in the line of his specialty. As soon as this became known the specialists of the country dropped their reluctance to enter the service. The first step in carrying out this policy was the grouping of those specially qualified into a Section of Surgery of the Head. The specialties which form this group are Ophthalmology, Oto-Laryngology, Brain Surgery and Oral Plastic Surgery of the face.

Other specialties for instance, Orthopedic Surgery, Psychiatry, Venereal and Skin Diseases, and Genito-Urinary Surgery, also have been recognized and treated as sections.

It will be seen that with the advent of recognized sections for the various specialties, the older division of army medical work into the two divisions of surgery and medicine, is superseded by the following grouping:

1. Section of Internal Medicine.
2. Section of General Surgery.
3. Section of Orthopedics.
4. Section of Venereal, Skin and G. U. Surgery.
5. Section of Surgery of the Head.
6. Section of Laboratories and Infectious Diseases.
7. Section of Neurology, Psychiatry and Psychology.
8. Section of Roentgenology.

This grouping accepted, the chiefs of all the sections should have equal rank, since professionally each in his line is the equal of the other.

When the specialist begins his military training by assignment to a training camp, the fact that he is a specialist may be an embarrassment. For instance, should he become an instructor in any military subject, he cannot be taken away without interfering with the progress of the military instruction planned. This being the case, if he is held back from assignment to work in his specialty should he be needed, as has been the case frequently of late, he loses his individuality as a specialist, and the army loses the benefit of his special skill. Two methods of avoiding this are possible. The first is not to assign a specialist as instructor, so that he can always be available for immediate release. The second, and better method, is not to call any specialist from a training camp until the Commanding Officer of the Camp has been consulted by letter or wire. When the organization of the Medical Corps of the Army has progressed a little farther, this difficulty will in a great measure disappear, since the first assignments call for the most men. Later, but few men will be called for at a time.

Orders have already gone out and are being complied with, which call for a monthly visit of specialists at the various training camps. This furnishes, however, a record of the specialist only in the beginning of his military career. When he leaves the training camp, unless there is an immediate opening in his specialty to which he can be assigned, he is lost track of. In order to avoid this it is recommended that when he leaves the training camp, and for the rest of his military employment, he report by letter once a month to the office in the Surgeon General's office, who is the Chief of the Department of his specialty.

The medical officers for the Section of Surgery of the Head who have been assigned to the cantonment hos-

pitals have been listed according to their specialty and ordered for duty in it. It is recognized, however, that in the beginning when all the work is in the rough there will be but little for them to do. During this period, therefore, they would naturally be asked to join in any medical work that was necessary.

Having placed the specialist at once in his specialty it is necessary in order to keep his efficiency at the maximum, that he should not be taken from it except in case of great emergency, and that in actual war conditions he should see his case at the earliest possible moment. Men trained in special work are to be stationed in the evacuation hospital or even nearer the front. The specialist in this way sees his case at the very beginning, and the case in its progress to the rear receives an ever increasing amount of special care until the hospitals for surgical repair and re-education have finished with the injured man and returned him to civil life.

In order to serve the interests of the surgeons working in the surgical specialties of the head, an oto-laryngologist, an ophthalmologist, a brain surgeon, and an oral plastic surgeon, have been assigned to the Surgeon General's office. As they know the personnel of their specialties they act both in an advisory capacity and as an information bureau for the specialists of the country. In order to make sure that the plans formulated in the Surgeon General's office for the correlation of the specialists of the head carry out in practice, two members of the section have been selected to visit various cantonments, both National Guard and National Army, to furnish information as to the reasons for subdividing these hospitals into specialties, and to see that the personnel selected by this department is in every way qualified to carry out the work assigned.

The personnel of the Section of Surgery of the Head of each Cantonment Hospital includes one brain surgeon. This assignment is primarily for the purpose of caring for the brain cases occurring in the service of the

hospital, and secondarily, to acquaint the surgeon with the methods of management of a military hospital, preparatory to going abroad.

A general surgeon especially trained in plastic and oral surgery, is one of the personnel of the section of surgery of the head. He has associated with him as assistants, one dental oral surgeon, and except in evacuation hospitals, also one dentist. Because of the probable small number of brain and plastic oral cases in the Cantonment Hospital, the surgeons of these two divisions will assist each other in caring for their respective cases. In the special building for the Section of Surgery of the Head there are special operating rooms. One of these is set aside for the services of oto-laryngology. This room is to be shared jointly by the oto-laryngologist, the brain surgeon and the oral plastic surgeon. Whenever the Brain Surgeon and the Oral Plastic Surgeon need instruments not in the oto-laryngological equipment they are to be obtained from the general surgical equipment.

The surgeon in charge of Plastic and Oral Surgery has charge of injuries and surgical diseases of the mouth, and its essential structures, including the bony frame work and soft structures of the face, and also of the neck when the major part of the injury is situated above the clavicle.

Exception to this classificaton is made in injuries and surgical diseases limited to the orbit or its appendages when the attending Ophthalmologist elects to do the work himself.

In injuries and diseases of the external nose and external ear and the accessory sinuses, when the attending Oto-laryngologist elects to do all the work himself.

In injuries and surgical diseases of the larynx when the Laryngologist elects to do the work himself.

In thyroid diseases, and in special cases of injuries of the peripheral nerves and the spinal column.

The commanding officer or the surgeon in charge of the hospital may delegate such other work to the sur-

geon in charge of Oral Surgery as the exigencies of the situation may dictate.

In the absence of the Oral Plastic Surgeon the Dental Oral Surgeon represents the Oral Surgery Division of the Section of Surgery of the Head. The Dental Oral Surgeon is advised to consult the surgeon in charge of the Section of Surgery of the Head in any question that may arise in the apportionment of cases or in the Dental Oral Surgeon's relations to the Oral Surgical and General Hospital work.

In cantonments the Dental Oral Surgeon's main work will be detecting and treating focal infections about the gums and jaw bones, of which there will be a great amount. There may not be enough Oral Surgery to fill all of the Dental Oral Surgeon's time, or the Dentist Assistant's time, in which case he will do such other work as the Surgeon may delegate to him.

(Signed) W. C. Gorgas,
Surgeon General U. S. Army.

The question of the advisability of this memorandum being the most acceptable for the organization of base and general hospitals under war conditions was under consideration at several conferences. As a result of the deliberation of these conferences, the plan as thought more acceptable was adopted November 3, 1917. This plan divides the services in Surgical, Medical, Laboratory.

Surgical Service.

1.	Chief of Service	Chest
		Abdomen
	4 Surgeons	Fractures
		General
	1 Surgeon	Orthopedic
		Urology
	4 Surgeons	Brain
	Head	Ear, Nose & Throat
	Section	Eye
		Oral, Face & Mouth

Medical Service.

1 Chief of Service
3 Physicians
1 Neurologist
1 or 2 Psychiatrists (In Hospitals U. S.)

Laboratory Service.

1.	Chief of Service	Pathology
	1 Assistant	Serology; Bacteriology

This organization received the approval of the Surgeon General.

Reorganization of Base and General Hospitals 500 Bed Basis.

The Manual of the Medical Department, together with the rules and regulations for the governing of the United States Army General Hospitals, covers the organization of Base Hospitals in a satisfactory manner, and in sufficient detail, except so far as relates to the professional division.

Paragraph 761 provides that, so far as adaptable, the regulations for General Hospitals will govern the administration of Base Hospitals. Paragraph 290 is a tabular statement furnishing a working plan of administration.

It should be noted that a Chief of Surgical Service and a Chief of Medical Service are specified.

Paragraph 307 outlines the duties and responsibilities of Chief of Service. These may be selected from any section, ability and experience being the determining factors.

It is recommended that memorandum previously issued by the Surgeon General and Paragraph 290 be amended to provide for three Services, namely, Surgical, Medical and Laboratory, with a Chief for each Service, and further, to provide that each of these Services shall include the following special Sections, or as many as may be necessary.

SURGICAL SERVICE.

1.	Chief of Service	Chest
		Abdomen
		Fractures
	4 Surgeons	General
	1 Surgeon	Orthopedic
		Urology
	4 Surgeons	Brain
	Head	Ear, Nose & Throat
	Section	Eye
		Oral, Face & Mouth
	1 Roentgenologist	
	2 Dentists	

MEDICAL SERVICE.

1. Chief of Service
   3 Physicians
   1 Neurologist
   1 or 2 Psychiatrists (In Hospitals U. S.)

LABORATORY SERVICE.

(Includes Pathology, Bacteriology, Serology, Chemistry and Morgue)

1.	Chief of Service	Pathology
1.	Assistant	(Serology; Bacteriology)

(All other workers in the Laboratory will be under the direction of the Chief of Service.)

For the Head Section a Section Chief may be designated, if desired.

The Commanding Officer will organize a convalescent camp as the conditions warrant.

NURSING SERVICE.—The Nursing Service remains as at present, with the provision that the number of nurses may vary according to the needs of the service.

In the assignment of non-commissioned officers and privates, the Manual may be followed or modified as the Service demands.

It is also recommended that Paragraph 307 be amended to read: "The Chiefs of the Medical, Surgical and Laboratory services will be responsible, etc. . . ."

Approved by the Surgeon General.

On October 5, 1917, an order was issued by Major Winfred Smith of the Hospital Division for one oto-laryngologist for each of 50 Base Hospitals to be sent abroad. This list has been completed.

War Department.

Office of the Surgeon General,

Washington, October 5, 1917.

To the Chiefs of Divisions:

1. It is desired to begin the organization at once of 50 base hospitals for foreign service, beginning with number 54. These are to be organized on a basis of 500 beds and will include the following professional personnel:

1 Commanding Officer	2 Dentists
1 Adjutant	5 Physicians
1 Quartermaster	1 Neurologist
1 Registrar	2 Pathologist & Serologists
5 General Surgeons	1 Roentgenologist
1 Orthopedic Surgeon	65 Nurses
1 G. U. Surgeon	153 Enlisted Men, including:
1 Brain Surgeon	1 Master Hospital Sergeant
1 Ear, Nose & Throat Surgeon	1 Hospital Sergeant, 1st Class
1 Ophthalmic Surgeon	4 Cooks
1 Oral Surgeon	10 Assistant Cooks

2. You are requested to select such part of this personnel for each of these base hospitals as comes under your section.

The personnel for each base hospital should be on a separate sheet, with the number at the top, beginning

with No. 54. It is requested that these returns be made to this office in lots of not less than ten (10) at one time and that the lists be in duplicate.

3. It is requested that as soon as men are selected, steps be taken to insure the reservation of these men for the duty for which they are selected.

4. It is desired to produce well-balanced units and it is not desirable to assign to any one unit more than a minimum number of the older and more expert men. In this preliminary organization, it is not considered desirable to assign more than six majors to a unit and these should be distributed in the different services. The other personnel should be composed of younger men. The General Surgical Section and the General Medical Section need only select the Chief Surgeon and Chief Physician and one assistant at this time, although it would be well to select the complete personnel for at least ten (10) units and to begin the tentative tabulation of the names of all the remaining personnel for all units.

5. It is requested that the names submitted shall represent men who have received and accepted their commission.

(Signed) WINFRED SMITH, Major,
M. R. C.

During the second week of October Major Harris P. Mosher made an inspection tour of the Eastern group of cantonments.

On October 24, 1917, the chairman of your committee made a report of the activity at the meeting of the Clinical Congress in Chicago. (Exhibit 16.)

Reconstruction—In September, Dr. James Bordley, chairman of the Sub-Committte of Ophthalmology was assigned by Lieut. Col. Lyster at the direction of the Surgeon General to represent the Section of Surgery of the Head in the reconstruction bureau under Major King, U. S. A. At the same time Major Charles W. Richardson was designated to represent through Major James Bordley the Otolaryngologic section. Major Richardson's participation was

in the proposed reconstruction of the defects in hearing and speech as a result of casualty in the war.

On September 22, 1917, Major Richardson had a meeting of physicians interested in the defective in hearing and speech, and teachers of the deaf, and as a result of this meeting the following report was made to Major Bordley. (Exhibit 17.)

On October 8th, a reply was received from Major Bordley requesting more detailed information embodying a plan of reorganization. (Exhibit 16.)

The subject of this letter was most thoroughly considered by the committee and a detailed report as requested by Major Bordley was submitted. (Exhibit 19.)

On account of the uncertainty which existed in the reconstruction bureau as to the part which this bureau would play in the program of reconstruction, the activity of your committee in the general scheme of reconstruction has been held in abeyance to the time of this writing December 6, 1917.

ACTIVITIES,

Oct. 25, 1917. Major Charles W. Richardson reported for duty, Section Oto-laryngology, Division Surgery of the Head, Surgeon General's Office, October 24, 1917. Major Harris P. Mosher relieved from duty in Surgeon General's Office and ordered overseas.

Oct. 25, 1917. Major Charles W. Richardson attended Congress of Clinical Surgeons, Chicago, October 25th and 26th. Read before the Congress a paper on the activities of the Section of Oto-laryngology as a part of the symposium on the specialties in the Surgeon General's office.

Nov. 10, 1917. Preparation of a card-diagnostic sheet for use in Base Hospitals at Cantonments.

Nov. 17, 1917. Report to Major King with regard to the reconstruction of the defects in hearing and speech.

Dec. 1, 1917. Major H. W. Loeb placed on active list and assigned to Surgeon-General's Office for inauguration of work in connection with the proposed war manual on Oto-laryngology.

Dec. 8, 1917. Completion of assignments of Oto-laryngological officers for over-sea base hospitals.

Dec. 15, 1917. Completion of history on War Activities of Section of Oto-laryngology, Division of Surgery of the Head, to December 5, 1917, and submission of same to Major Garrison, Chief of the Division on History of the War.

Dec. 22, 1917. Re-consideration of the instruments in Oto-laryngology in cases and as listed in paper, to be furnished

Base Hospitals in the National Cantonments, National Guards and for Over-seas; revision, enlargement and completion thereof, and additional instruments listed.

Jan. 2, 1918. Assignment to and meeting with board for revision of rules for the physical examination of registrants.

Jan. 12, 1918. Conference with Division of Special Hospitals and Physical Reconstruction.

Jan. 19, 1918. Re-writing and presentation of scheme for physical examination of registrants in ear, nose and throat.

Feb. 2, 1918. Preparation of curriculum in Oto-laryngology for contemplated Army Medical School, and the designation of amount of required space for Oto-laryngological Section in Medical Military School to be established at Camp Greenleaf, Fort Oglethorpe, Georgia.

Feb. 6, 1918. Attendance and presentation of reports at meeting of the Eastern Section, America L. R. & O. Society.

Feb. 10, 1918. Transfer of the special section of reconstruction work in defects of hearing and speech to the Oto-laryngological Section of the Division Surgery of the Head, with Major Charles W. Richardson designated in charge. This section was formerly grouped under the Ophthalmological section under Major James Bordley.

Mar. 10, 1918. Major Charles W. Richardson assigned to duty in the Division of Special Hospitals and Physical Reconstruction, assigned to Section of Defects in Hearing and Speech.

Mar. 15, 1918. Major Mosher returned from oversea trip. Major Charles W. Richardson relieved from duty in the Section of Oto-laryngology, Division of Surgery of the Head.

(Signed)

CHARLES W. RICHARDSON, Chairman.
HARRIS P. MOSHER.
J. H. BRYAN.

Exhibit No. I.

COUNCIL OF NATIONAL DEFENSE,
WASHINGTON.

July 7, 1917.

DEAR DOCTOR:

You are requested to fill out this form and return at once in the enclosed envelope.

I. Name: Address:
II. Age: Married or Single?
III. Country of birth: Are you naturalized?
IV. Place and date of graduation?
V. Past hospital connections?
VI. Present hospital connections?
VII. Number of years in Oto-laryngology?
VIII. Foreign languages spoken?
IX. Military or naval experience?
X. Are you a member of the Medical Officers' Reserve Corps, U. S. A.?
XI. Are you a member of a Base Hospital Unit? If so, what unit?
XII. Will you accept service in the Army or the Navy if the Government so desires?
XIII. Have you received a questionnaire from the sub-committee on ophthalmology?
XIV. Have you answered it?
XV. Do you prefer to be classified under the ophthamologic or oto laryngologic section?

Sincerely yours,

FRANKLIN MARTIN,
Member Advisory Commission
Council of National Defense.

Sub-Committee on Oto-laryngology,
General Medical Board,
Council of National Defense.
Charles W. Richardson, Chairman,
Harris P. Mosher,
Burt R. Shurly,
Major Theodore C. Lyster, U. S. A.
Surgeon G. E. Trible, U. S. N.

F. F. SIMPSON,
Chief of Medical Section,
Council of National Defense.

Exhibit No. 3.

Returned questionnaires classified under the following Heads:

1. Accepted
2. Accepted for future service
3. Accepted qualifiedly—depending on rank or assignment to duty
4. Indefinite
5. Member M. O. R. C.
6. Applied for M. O. R. C.
7. Unavailable
   - Members Base Hospital Units
   - Members Teaching Staffs
   - Members Hospital Staffs
   - Officers in National Guard
   - Officers in Navy
   - Officers in Public Health Service
   - Not Citizens
   - Beyond Age Limit
   - Physically Unfit
   - Females
   - Dead
8. Excused
   - Civil obligations
   - Those with dependents
9. Within draft Age Limit
10. General Surgeons
11. Refusals
12. Slackers

Exhibit No. 4.

COUNCIL OF NATIONAL DEFENSE,
WASHINGTON.

DEAR DOCTOR:

We note in your reply to our questionnaire that you are under thirty-one years of age. As you are subject to draft, we would advise you to make application at once for a commission in the Medical Section Officers' Reserve Corps.

When feasible men under thirty-one will be used in the specialty in which they have been trained, but with no promise on the part of the War Department for such service, the special work naturally being reserved for men of larger experience.

Sincerely yours,

CHAS. W. RICHARDSON, Chairman,
Sub-Committee on Oto-Laryngology,
General Medical Board.

Committee:
Harris P. Mosher,
Burt R. Shurly,
Major Theodore C. Lyster, U. S. A.
Surgeon C. E. Trible, U. S. N.

Exhibit 5.

COUNCIL OF NATIONAL DEFENSE,
WASHINGTON.

DEAR DOCTOR:

As your reply to question 12—"Will you accept service in the Army or Navy to be classified in the Oto-Laryngologic Section, if the Government so desires?"—of the questionnaire of the Sub-Committee on Oto-Laryngology of the General Medical Board of the Council of National Defense *was in the affirmative*, we are enclosing you application blanks for appointment in the Medical Section Officers' Reserve Corps.

As the Government is in serious need of your services *at once,* we trust that you will file your application at the earliest possible moment.

Sincerely yours,

CHAS. W. RICHARDSON, Chairman,
Sub-Committee on Oto-Laryngology,
General Medical Board.

Committee:

Harris P. Mosher,
Burt R. Shurly,
Major Theodore C. Lyster, U. S. A.
Surgeon G. E. Trible, U. S. N.

Exhibit 6.

WAR DEPARTMENT,
OFFICE OF THE SURGEON GENERAL,
WASHINGTON.

DEAR DOCTOR:

In replying to the questionnaire of the Sub-Committees on Ophthalmology and Oto-laryngology of the Council of National Defense you stated that you were not qualified to serve as a specialist. As you signified your willingness, however, to serve in the army will you not fill in the enclosed application blank for commission in the Medical Reserve Corps, U. S. A., and report at once to the nearest examiner for examination.

The Army is in serious need of the services of such trained men as yourself.

R. N. MILLER,
Major, Medical Corps, U. S. Army.

Exhibit 7.

WAR DEPARTMENT,
OFFICE OF THE SURGEON GENERAL,
WASHINGTON.

DEAR DOCTOR:

In reply to the questionnaire sent you by the Sub-Committees on Ophthalmology and Oto-laryngology of the Council of National Defense you signified your willingness to accept service in the Medical Officers' Reserve Corps as a specialist, but stated that you have not practiced as a specialist exclusively. It is the policy of the Surgeon General at first to utilize as specialists only those who have had the largest clinical experience; that is, men who have practiced ophthalmology and oto-laryngology exclusively for at least eight to ten years. Your general medical training will make your services most valuable to the Medical Department in general work, and you are needed.

In this emergency will you not subordinate your personal desires to the good of the cause for which we are fighting and at once send in your application for the Officers' Reserve Corps? (Application blanks enclosed).

R. N. MILLER,
Major, Medical Corps, U. S. Army.

Exhibit 8.

COUNCIL OF NATIONAL DEFENSE,
WASHINGTON.

DEAR DOCTOR:

In reply to your letter of inquiry, the Sub-Committee on Ophthalmology and Oto-Laryngology refers you to the following:

1. Officers of the medical reserve corps who have specialized in Medicine or Surgery will be given an opportunity to perform the duties of their specialty when feasible, men of larger experience naturally being given preference.

2. In the Medical Reserve Corps there are three grades, viz., Lieutenant, Captain and Major. It is the policy of the Surgeon General's Office to recommend the great majority of applicants for commission in the grade of First Lieutenant, with the exception of making numerous promotions when the officers concerned have had an opportunity to demonstrate their professional qualifications and their adaptability to the military service after a reasonable period of active duty. Applications for increased grade are not favorably considered unless they come through military channels, in order that the Surgeon General may have the benefit of the recommendations made by the applicant's superior officers. Political influence is unnecessary.

In making recommendations for original commission *age, professional attainments, and previous military experience,* are the chief considerations in determining the grade in which the applicant should be commissioned.

3. The pay of the different grades is:

First Lieutenant	$2,000.00.
Captain	2,400.00.
Major	3,000.00.

When assigned to duty in a city (not in camp, thus not serving with troops) the assignment carries with it commutation of quarters:

First Lieutenant	3 rooms	at $12.00 per room heat and light additional.
Captain	4 rooms	
Major	5 rooms	

4. Acceptance of a commission in the M. R. C. automatically places your service at the disposal of the Surgeon General wherever he deems them the most valuable, either in the United States or abroad.

5. Acceptance of commission is for five years, unless sooner relieved from active duty on recommendation of the Surgeon General, when officers will be placed on the inactive list. Active duty in the present instance will naturally be for the length of the war plus four months, which will be required for the necessary physical examinations to be made of the men before they are discharged from the army. The old requirements of three years service, including at least ninety days' active service, before being eligible for promotion has been eliminated.

6. In case of death from causes in line of duty the Government pays to the widow or designated beneficiary six (6) months' pay of the grade held by the deceased at the time of death. The deceased's family is also entitled to a pension.

7. The limited number of quarters at the majority of stations and camps makes it inadvisable for Officers of the Reserve Corps to be accompanied by their families, unless they can provide for them independently.

8. In no event will the families of officers be allowed to accompany them abroad.

9. Officers in the Medical Reserve Corps under the age of 45 years will be called for training in the medical officers' training camps. This is for the purpose of giving intensive training in administrative duties, a requirement for military service. Men over 45 years, if they so elect, may attend a medical officers' training camp. If a surgeon has had military training, he may be called, without camp instruction, for active duty.

The following paragraphs are added from a letter from the Surgeon General to the chairmen of the State Committees of the Medical Section, Council of National Defense:

"1. It is believed that it would be of great advantage to this Department if each State Committee would make a census of its State with a view of dividing the medical profession into two classes: (a) those who cannot be spared for Army service because of their importance to the civil community; and (b) those who can be spared. Class (a) should be requested to refrain from offering their services. Class (b), on the contrary, should be encouraged promptly to apply for appointment. This office is frequently called upon to give advice along these lines in individual cases, but the Department does not care to assume this responsibility, believing as it does that the question is one that can much better be decided by the State Committee acting in conjunction with the County Committees.

"2. The Department will not feel called upon to consult the list prepared under paragraph 1 when individual applications are received, since it will be assumed in all cases that the individual offering himself can be spared and will be at the disposal of the Department for such duty as the exigencies of the service may demand.

"3. For the purpose of this census the State Committee should act as a clearing house for the County Committees.

"4. Frequently inquiries are made as to whether a medical officer will be assigned to duty in accordance with his medical specialty. In this connection, attention is invited to the fact that a large proportion of the administrative work of the Medical Department of the newly organized Army will fall upon the officers of the Medical Reserve Corps. The officers of the regular establishment are so few in number that they will be available for only the most important administrative positions. With this in mind, it will be readily understood that officers of the Reserve Corps must largely supplement their technical knowledge by a clear conception of military co-ordination and administration before they can be of the greatest service to the Department.

"5. They should offer themselves without reservation, considering their medical training as the basis upon which to build their education as medical officers.

"6. It is true, nevertheless, that all officers of the Reserve Corps are card indexed according to their special qualifications and that when the Army is fully organized and working smoothly, every effort will be made to assign each officer where his special qualifications will be most useful to the Government and where the work will be congenial to the officer himself.

"7. The Department has at its command, at present, only about one-fourth the number of officers that will be required for an Army of two million men. By the application of the selective draft the full quota can probably be raised without great difficulty. It will be more creditable to the profession, however, to attain this end by voluntary offer of service.

"8. A great deal of inconvenience has been caused those applying for appointment in the Medical Reserve Corps by reason of the delay in issuing commissions. The business of the War Department has expanded so rapidly that it has been impossible to secure the necessary additional assistance requied to handle the work. The delay has occurred in this office as well as in the office of the Adjutant General. The condition is being remedied as fast as circumstances permit.

"9. Your Committee is urged to take such steps as may secure the prompt acceptance of commissions issued, or their immediate return to this office."

Sincerely yours,

(Signed) Sub-Committee on Ophthalmology and Oto-Laryngology, General Medical Board.

Exhibit 9.

ALABAMA—
Charles Thigpen, First National Bank Bldg., Montgomery.
ARIZONA—
John J. McLoone, O'Neil Bldg., Phoenix.
ARKANSAS—
CALIFORNIA—
Hill Hastings, Los Angeles.
Henry L. Wagner, 518 Sutter St., San Francisco.
COLORADO—
Robert Levy, Metropolitan Bldg., Denver, Colo.
CONNECTICUT—
Henry L. Swain, 232 York St., New Haven.
DELAWARE—
Oliver D. Robinson, Georgetown, Del.
FLORIDA—
Wm. S. Manning, Jacksonville.
GEORGIA—
Dunbar Roy, Atlanta.
ILLINOIS—
E. Fletcher Ingalls, Chicago.
INDIANA—
John F. Barnhill, Indianapolis.
IOWA—
Lee W. Dean, Iowa City.
KANSAS—
KENTUCKY—
J. A. Stuckey, Lexington.
LOUISIANA—
Robert C. Lynch, New Orleans.
MAINE—
John H. Allen, Portland.
NEW JERSEY—
Wells P. Eagleton, Newark.
NEW YORK—
W. H. Haskin, New York City.
Thomas H. Halsted, Syracuse.
NEW MEXICO—
NORTH CAROLINA—
Jos. B. Greene, Asheville.
NORTH DAKOTA—
Thomas M. McLachlan, Bismarck.
OHIO—
John M. Ingersoll, Cleveland.
OKLAHOMA—
E. S. Ferguson, Oklahoma City.
OREGON—
Charles T. Chamberlin, Portland.
PENNSYLVANIA—
George M. Coates, Philadelphia.
RHODE ISLAND—
H. P. Abbott, Providence.
SOUTH CAROLINA—
J. Wilkerson Jervey, Greenville.

SOUTH DAKOTA—
Frank H. Putnam, Sioux Falls.
TENNESSEE—
Edw. C. Elliott, Memphis.
TEXAS—
Eugene R. Carpenter, El Paso.
UTAH—
VERMONT—
Edmond T. Brown, Burlington.
VIRGINIA—
Jos. A. White, Richmond.
WASHINGTON—
H. V. Wiendermann, Seattle.
WEST VIRGINIA—
Thos. W. Moore, Huntington.
WISCONSIN—
Henry B. Hitz, Milwaukee.
WYOMING—
Geo. L. Strader, Cheyenne.

Exhibit 10.

COUNCIL OF NATIONAL DEFENSE

WASHINGTON.

DEAR DOCTOR:

You have been selected by the Sub-Committee on Oto-Laryngology of the General Medical Board of the Council of National Defense to furnish, if possible, information as to the professional qualifications of certain applicants, for commission in the Medical Officers' Reserve Corps, classified in the Oto-Laryngological Section, with whom this committee is unacquainted. This information is for the Surgeon General's office and will be considered as *absolutely* confidential.

In your opinion are the candidates, whose names are enclosed, qualified professionally for Oto-Laryngologic Surgical work in the Army? This necessarily requires a sufficient knowledge to make a functional examination of the ear, nose and throat and the ability and skill to do general Oto-Laryngologic surgery.

Will you please classify them as to qualifications as: A—well qualified, B—qualified, C—not qualified. In making these recommendations, also, please consider the physical and moral qualifications.

Very truly,

CHAS. W. RICHARDSON, Chairman,
Sub-Committee on Oto-Laryngology,
General Medical Board.

Committee:
Harris P. Mosher,
Burt R. Shurley,
Major Theodore C. Lyster, U. S. A.
Surgeon G. E. Trible, U. S. N.

Exhibit 11.

Name:
Address:
Recommended for:
M. S. O. R. C.
Date of Acceptance:

Exhibit 12.

Name: Address:
Recommendations: Age: Married or Single: Dependents:
Country of Birth: Naturalized:
Date and Place of Graduation:
Past Hospital Connections:
Present Hospital Connections:
Foreign Languages Spoken:
Military or Naval Experience:
Member of M. S. O. R. C. Base Hospital: No. of Unit:
Remarks:

IMPAIRED HEARING RESULTING FROM CHRONIC SECRETORY CATARRHAL EXUDATIVE OR HYPERTROPHIC OTITIS MEDIA—CONTINUED. SECOND COMMUNICATION.

By MAJOR FRANCIS P. EMERSON, Boston, Mass.

In a previous paper on the subject of catarrhal deafness, read before the American Laryngological, Rhinological and Otological Society, May 31, 1917, the writer drew the following conclusions: 1st. Every case of chronic progressive middle ear deafness has a primary focus which persists as a low grade infection, subject to acute exacerbation. In chronic cases such foci are usually multiple. 2nd. Such primary focus is usually constant for the individual, and is indicated by the location of exacerbations. 3rd. Every case showing variable hearing can usually be improved up to their best hearing, or more. 4th. So-called cases of nerve deafness of non-specific origin are in the experience of the writer due to toxemia from some definite focus. 5th. Inflation in chronic cases is unscientific and harmful as a routine, as the tube is already open and has partly lost its tone in the majority of cases; and in those cases not open, it does nothing to remove the cause. 6th. Nasal obstructions do no harm to the middle ear unless infection is present. Such obstructions, however, are the primary cause in the development of imperfect drainage, which predisposes to infection, and which is always present in cases of chronic secretory otitis media originating in the nose. 7th. Foci, whether in the sinuses, tonsils, mandible or epipharynx, are potential factors in the progress of chronic progressive otitis media, either by direct extension or through the lymph and blood streams. 8th. No hearing test will forecast the improvement in a given case as long as we have a positive Rinné with variable hearing. 9th. Whatever the macroscopic appearance of the membrana tympani, the cause of the deafness is active for a long time outside the middle ear as a

toxemia, or low grade infection subject to acute exacerbations. 10th. Constitutional diseases have but little effect upon the course of chronic secretory otitis media, except to lower the patient's resistance and make him more susceptible to exacerbations of his localized focus or foci.

In the etiology of chronic secretory—exudative—catarrhal or hypertrophic otitis media, aurists are in accord as to the pathology and necessary treatment of the eustachian tube and middle ear, but there is still a wide diversity of opinion in regard to the conditions that have preceded the chronic state and as to what steps are necessary to arrest or improve a disease that effects the majority of our office clientele. If we consult our latest text books we find that adenoids are mentioned as *first* in the list of causes, and here, especially in children, there would be no controversy. The *second* (to still quote from the latest text books), recurrent attacks of subacute catarrhal otitis media, in which resolution is never quite complete, is given as a cause. *Third*, frequent attacks of acute rhinitis, each attack giving rise to more or less tubo-tympanic congestion. *Fourth*, obstructive nasopharyngeal lesions resulting in chronic tubal catarrh which later involves the tympanum. The writer would respectfully submit as a substitute for these subdivisions, except the first as a primary cause, the result of early infections usually the sequelae following the infectious diseases and La Grippe. These diseases leave a streptococcus focus which becomes chronic and is indefinitely subject to acute exacerbations, causing recurrent attacks of subacute catarrhal otitis media, frequent attacks of what seem to be acute rhinitis, yet are not fresh infections, but the lighting up of this chronic focus, and lastly making obstructive nasopharyngeal lesions potential factors in deafness only because the impaired drainage keeps up the chronic infection. In taking the histories of these chronic cases one is impressed with the fact that these patients have had various manifestations of the same infection, dating back to an attack of diphtheria, measles, scarlet fever, or La Grippe. These infections have resulted in secondary involvement of the lymphatic or osseous tissues,

such focal processes being subject to acute exacerbations, but existing as a low grade process in the interval. These exacerbations are so constant that it is a question whether acute infections ever take place in a normal nasopharynx. The writer confesses that in late years he has not been able to make a differential diagnosis between otitis catarrhalis adhesiva and the exudative catarrhs from the *view-point of etiology*. Many cases showing but little evidence of secretory changes in the membrana tympani with the nasopharynx clean and no thickening of the mucous membrane have had a definite chronic focus in the throat. In these cases the writer formerly relied upon the hearing test for a diagnosis. He now believes all of them to be due to a toxine, and any differential diagnosis should be based on the tissue reaction in the tympanum rather than upon any difference in origin. Some of the cases here cited show the final stage of an exudative process where the hypertrophic changes have been succeeded by secondary atrophy and nerve degeneration after a steady progression from the throat or nasopharynx to the eustachian tube, tympanum and inner ear. Many other cases with apparently the same etiology are followed by extreme deafness showing toxic nerve changes that seem to have been caused by absorption directly through the lymphatics or blood streams. The toxic focus that caused the nerve changes in the inner ear probably accounts for the intestinal toxemia referred to by Stucky and other writers.

May 28, 1917, E. J. P.—Born Rhode Island.—45 years. Married. Merchant. P. H. Diphtheria. Measles. Scarlet fever. No aural history in childhood. Rheumatism seven years ago. Laid up six to seven weeks. Acute infections in the head constantly. In 1901 had La Grippe, and lost the hearing in the right ear gradually. No history of discharge. Tinnitus with bad weather. Hearing varies with climatic conditions. Not so good when tired. History of operation in left nose twenty years ago. Never been right since.

Examination: *Nares*—L. Posterior spur and senechia almost closing the posterior naris. Contact with posterior

end of inferior turbinate. Cryptic tonsillar disease. Central adenoid. Both eustachian tubes obstructed at the isthmus. Right more open at pharyngeal end.

Ears—A. D.—Membrana tympani indrawn. Capillaries injected along the manubrium. L. R. gone. Ground glass appearance.

A. S.—Membrana tympani indrawn. Ground glass appearance. All forks above 512 heard.

R			L
1/6/25		W. V.	1/6/25
11″ 24″	R	$512C^2$	6″ 22″
6″ 9″		$256C^1$	6″ 8″
		+ < W	
96		L. L.	96

No alcohol—tobacco moderate—no venereal history.

X-ray of the teeth and sinuses negative.

Operation at Brooks Hospital—May 29, 1917. Senechia removed. Spur removed with saw. Both antra opened Tonsil and adenoid operation. (Right tonsil contained free pus).

Nov. 16, 1917—Right eustachian tube. Duel's electric bougie (constriction thick at isthmus and would admit only the second size Yankauer bougie). Injection along the manubrium disappeared. Tinnitus stopped. Reaction caused return of tinnitus and tube could not be bougied.

Dec. 28, 1917.—Right eustachian tube—Electrolysis.

Feb. 28, 1918—Both tubes open. Bougied, argyrol 20 per cent. on cotton applicator. Sinusoidal current (Multiplex and Slow), using each five minutes in each ear.

The above case shows a hearing test resulting from a toxic focus. As complications we have marked nasal obstruction, lymphoid tissue in the vault, and decided narrowing of both eustachian tubes at the isthmus with diseased tonsils, the free pus in the tonsils being the most important.

Status Presens—After treatment for a year his eustachian tubes are open, the tinnitus and feeling of obstruction gone, but his hearing remains unchanged. He has had one acute infection during the year at the time of a general epidemic.

If we admit that a pyogenic focus can be present throughout life as a streptococcus infection, subject to acute exacerbations, then we must concede that toxemia with subsequent nerve degeneration plays a more important part in non-suppurative middle ear deafness than we have supposed in the past. From analogy we would expect that the synapses of the auditory pathway that are sensitive to the poisons of quinine, salicylic acid, morphia, alcohol, tobacco, etc., would also be vulnerable to constant toxic absorption from a focal process. Clinically this seems to be so, and also there seems to be a selective action that sometimes involves the cochlear and sometimes the vestibular branch of the auditory nerve.

It is known by all aurists that following a suppurative otitis media the ossicular chain may be broken by necrosis and sloughing, leaving wide gaps in the conducting apparatus, in addition the membrana tympani may be gone and yet the patient may hear very well. Cases of effectiva otitis media may show calcarious deposits with marked thickening of the whole drum, and yet there may be a fairly good functionating ear. On the other hand, many cases of catarrhal deafness may show but little change in the membrana tympani and yet have considerable loss of hearing, especially in the upper register. Is this due to changes in the conducting apparatus or is it due to beginning auditory nerve degeneration, or to both causes? In the judgment of the writer it is not necessary to have marked changes in bone conduction, unless it be to raise it in the early stages, to have toxic nerve deafness in connection with the evidence of an exudative catarrh in chronic hypertrophic otitis media. In these cases there is often a hearing test that is almost identical on both sides. Represented graphically it would be like the following for a chronic condition.

Malleus moveable. Forks above 512 heard faintly or not at all.

Tinnitus marked.

R		L
Shout	W. V.	Shout
12″/22″	Rinné 512′″	10″/20″
	W > +	
512	L. L.	512

This patient, 48 years of age, commenced to be deaf as a girl following scarlet fever. Diseased tonsils with a low grade pharyngitis and progressive loss of hearing without marked attacks of tonsillitis was the subsequent history. In cases of this type the writer believes that in the hypertrophic stage of catarrhal otitis media mechanical obstruction to the sound waves is an important factor in impairment of hearing. When, however, secondary atrophy has commenced and the infection has extended well into the eustachian tubes as a chronic process, then the effect of toxemia upon the auditory labyrinth or auditory nerves is equally important with extension from the tympanum. Tinnitus, which is only another name for vestibular irritation, has for its exciting cause changes in the eustachian tubes more often than anywhere else. The loss of tension or the relaxation of the membrana tympani being not so much a cause of deafness as is the fact that this condition indicates a wide open and usually infected eustachian tube with secondary atrophy, except in a few cases when it is due to auto-inflation or repeated Politerization.

The accompanying hearing test shows the result of a long continued toxic process acting in the same way as the systemic poisons upon the auditory labyrinths or auditory nerves. These cases are very common in which the hearing test is almost identical on both sides, the stapes movable, and in which a diagnosis of otitis catarrhalis adhesiva is usually made. The clinical history is one of frequent days marked by malaise, the hearing is worse with the exacerbations of the throat irritation or exhaustion, and the etiology dates back to a streptococcus infection following either Grippe or the infectious diseases. The writer has seen many similar cases that were examined earlier, while the Rinné test was still positive, that seemed to point to some systemic poison and in which syphilis was considered as a probable cause. A careful history often revealed a very definite beginning of the deafness with the exciting cause still active after a long number of years. In many cases the pharyngeal vault is free of lymphoid tissue and there is

no history of head infections. The patient may even deny any tendency to sore throat and yet the degenerate and infected tonsil in adults is usually the seat of the auto-intoxication and deafness. We may not be able to make a diagnosis of a toxic focus, however, without noting the injection of the pillars of the palate, the perverted secretion of the pharynx, and the location of acute exacerbations, the macroscopic pathology of the gland itself not being sufficient ground upon which to base our conclusions. In association with these cases of lymphoid infections are many latent antra and apical abscesses of the teeth that may be overlooked more easily than pyogenic foci elsewhere, as, for instance, the ethmoid labyrinth. In chronic hypertrophic otitis media frequent attacks of rhinitis or recurring attacks of tubo-tympanic congestion are the rule, because the primary cause remains latent, and exhaustion is as productive of an acute exacerbation as is exposure. Whether the otoscopic examination of the tympanum indicates a previous exudative catarrh or is clear, depends upon whether the toxine was absorbed directly through the lymphatics or blood stream, or first caused a low grade process in the epipharynx, tube and tympanum. Both conditions may obtain in the same patient with the same etiology.

The following case is typical of a low grade infection existing for years, causing a chronic hypertrophic otitis media. The long continued toxemia has resulted in beginning auditory nerve degeneration, giving a typical hearing test.

March 18, 1918—Mrs. R., 52 years. Born, Massachusetts. Married.

P. H.—Always well and not subject to acute infections. Commenced to grow deaf twenty years ago. There has been a gradual loss of hearing each year since. She has been under the constant care of a good aurist whose treatment has been directed largely to the tubes.

Vertigo—No history of.

Tinnitus—Slight once for 24-48 hours.

Headaches—History negative.

Hearing not affected by climatic conditions.

Scarlet fever at four years, diphtheria at fourteen years, measles at 10 years. Throat trouble commenced as a child.

Examination:

Ear—A. S.—But little change in M. T

A. D.—M.T. Ground glass appearance. Manubrium not injected. Indrawn. L. R. gone. No areas of atrophy or thickening.

Nasopharynx—Breathing free—Septum straight, no posterior hypertrophies. Drainage good. No infection. Accessory sinuses negative.

R. Fossae free.

Pharynx—Low grade pharyngitis, especially marked on the sides. M. M. looks thickened and darkly congested.

Tonsils—Cryptic tonsillar disease. Both small and submerged. Patient now states that for years she has had an unusual amount of thick secretion in her throat, especially in the morning. That it is not unusual for her to get up nights to clear her throat and that the throat is always rough.

Teeth show no apical abscesses.

Hearing—

R		L	1024C[3] faint in A. D.
Shout	W. V.	Shout	2048C[4] not heard in A. D.
7″/15″	R512C[2]	5″/15″	2048C[4] faint in A. S.
	Weber > +		No stapes fixation
—	G	—	(Gelle test negative)
256	L. L.	256	Air and bone conduction both lowered.

Diagnosis: Both—Otitis media secretory chronic cum with a low grade pharyngitis, the result of a chronic tonsillar infection. Beginning auditory nerve degeneration.

Treatment: Tonsillar exenteration. Topical applications to pharynx.

It is well to emphasize in connection with this case the fact that it is not necessary to have a history of repeated attacks of tonsillitis, or to be able to demonstrate the presence of free pus in the degenerate type of tonsil so often

found in patients between 40 and 60 years of age. All cases that are causing toxemia do have, in the experience of the writer, an accompanying low grade pharyngitis with roughness and a tendency to clear the throat on rising and perverted secretions. In this case the right ear shows the result of an exudate catarrh in the right tympanum. The left membrana tympani is clear, of pearly luster, and the light reflex is present, yet the hearing tests are practically the same.

To conclude we find our etiology to consist in a chronic infection subject to acute exacerbations with varying degrees of virulency, constantly tending to invade contiguous as well as remote structures by continuity or through the lymphatics or blood stream. The tissue reactions in the tympanum especially about the ossicular joints seem to be the same as the reaction in other articulations to the irritation of a definite toxine. It is, therefore, obvious that treatment will be useless after secondary atrophy, arthritic changes in the ossicular articulations, or auditory nerve degeneration has taken place. The one serious problem is to establish immunity to a chronic infection. Drainage is essential, but there are secondary foci beyond our reach in many chronic cases. These cases must be treated on broad lines of corrected metabolism, hydrotherapy. Out-of-door living, rest, etc., as well as locally, remembering that audition is only one function gone wrong in the symptom complex.

The improvement to be expected cannot be determined by the duration of the deafness or age of the patient, but by a careful examination. Very many cases can be helped, as shown by actual hearing tests. In others the process can be arrested. Many will have relapses on account of secondary foci and poor resistance. Others will show beginning auditory nerve degeneration, but eliminating those cases that have passed beyond our aid, there are still a large number where we can expect good results that will be in proportion to our thoroughness and patience in searching out and draining chronic toxic foci and curing the attending in-

fection. One point that should be emphasized is that very early in the exudative catarrhs you may have beginning auditory nerve degeneration without marked lowering of the bone conduction, as well as changes in the tympanum.

Most of the cases here cited represent the terminal stage of a long continued exudative or catarrhal process. At the beginning, one ear is more involved than its fellow, but with time the infection extends to the opposite side, until, in many cases, the hearing may be identical. If the advance has been by way of the eustachian tube and tympanum the hearing for the two sides is more apt to vary than when the toxine acts directly by way of the lymphatics and blood stream. It is obvious that any improvement depends upon early removal of the cause and that any treatment by inflation or other means that does not take into consideration the existing infection is not only a loss of time, but makes the patient ultimately worse, except an occasional use of such treatment in the hypertrophic stage.

Discussion.

Dr. Christian R. Holmes, Cincinnati, Ohio, considered this an unusually valuable paper, inasmuch as it dealt with the treatment of a type of cases which had been such a nightmare to otologists in the past, in the management of which they were only now beginning to see the light. The speaker, dwelling particularly upon the tendency of rhinologists to proceed at once to cut out every nasal spur, emphasized the point that the important question was not the presence of the spur, but the interference by the spur with the breathing space. The younger specialists should be warned against cutting off every spur found. It is very common to find serious infection in these cases, as was well known. The ethmoid cells, especially the posterior, are infected in a large number of cases. The sphenoid opening can, in most cases, readily be seen by an operation on the middle turbinates, but infection of the posterior ethmoid cells is not as easily diagnosed, and one does not want to open them unless it is absolutely necessary. The ordinary routine practice of prob-

ing, douching and swabbing, without radial interference in chronic cases, is a serious mistake. Everyone has seen cases in which over-treatment and insufficient treatment has done harm, not reaching the source of the trouble. He hoped that every young man who practiced otology would have the opportunity of reading Dr. Emerson's paper.

EPIDEMIC CEREBROSPINAL MENINGITIS WITH MIDDLE EAR SUPPURATION, RESEMBLING OTITIC MENINGITIS.

By W. E. SAUER, M. D., St. Louis, Mo.

The following cases of epidemic cerebrospinal meningitis with ear involvement intercurrently, came under my observation during the past year.

Case 1. On April 25, 1917, Dr. M. A. Bliss a neurologist requested me to see a case of meningitis, which he thought was due to an extension from a chronic middle ear suppuration. The history obtained from the relatives of the patient was as follows: The man, M. E. aged 24, had always enjoyed good health, with the exception of a foul smelling discharge from both ears, which had existed since childhood. This had caused him no inconvenience, except the deafness. On the morning of April 24th, the patient awoke complaining of an intense headache; his physician found no cause for the headache. The following morning the patient began to vomit and grew very restless, and at times delirious. Dr. Bliss had been asked to see the case late that evening; he found the patient in bed, extremely restless, delirious and unable to answer any questions. His examination revealed muscles of the neck rigid, a definite Kernig and Babinsky; in fact a typical picture of a leptomeningitis. The knowledge that the patient had two chronic suppurating ears led Dr. Bliss to conclude that the meningitis was an extension of the suppuration from the ears, or one of them.

My examination disclosed a bilateral chronic suppurative otitis media, with no evidence of mastoid involvement on either side. The patient was sent to the hospital, where we did a lumbar puncture. The fluid escaped under great pressure, and was very turbid. We decided to await the laboratory report before deciding on any operative procedure. The report of the bacteriologist follows:

"Smears from spinal fluid M. E., show an enormous number of leucocytes and some lymphocytes. There are many diplococci present which are both intra and extra cellular. These organisms are gram negative. Take counter stain. Cultures show diplococci in pure culture. Gram negative. Diagnosis: epidemic cerebrospinal meningitis."

This came as a great surprise, as the possibility of its being the epidemic form of meningitis was not considered. There was no history of exposure, nor were there any other cases in that section of the city, as far as we could learn. The patient was transferred to the Isolation Hospital, where he died the next day.

Case 2. Mr. D. aged 48, was first seen on Nov. 11, 1917. He had been complaining of pain in the left ear for a week. The family physician had given some ear drops for him, which did not relieve the pain. Several days after the onset of this pain in the ear, the patient developed a severe headache which prevented his sleeping. On attempting to walk he became dizzy and fell. His wife had noticed that one pupil was larger than the other. At this time Dr. R. E. Kane, to whom I am indebted for the case, saw the patient. He found him with a high temperature and delirious, and other symptoms suggesting a meningitis. My associate, Dr. Hourn saw the patient with Dr. Kane. He found the right ear negative. The left membrana tympani was congested and bulging, and on incision a free discharge of pus followed. The fact that the meningitis followed so soon after the middle ear involvement and in view of our experience in the case just reported, we suspected that this might be a case of epidemic cerebrospinal meningitis. It was impossible to do a lumbar puncture at the home of the patient, so he was removed to the St. Louis Mullanphy Hospital. We found the cerebrospinal fluid under considerable pressure, cloudy and turbid. This was immediately sent to the bacteriologist, who reported as follows:

"Direct smears from spinal fluid J. D., show the presence of a great many leucocytes and some lymphocytes. There

are numerous diplococci which are both intra and extra cellular. These are gram negative organisms. The cultures next day also showed the presence of a gram negative diplococcus. Diagnosis: epidemic cerebrospinal meningitis."

The patient was sent to the Isolation Hospital where he died the next day. This too, was apparently an isolated case, as no other cases had been reported from that section of the city.

A review of the literature at our disposal gives but meager information as to the role of the meningiococcus in the etiology of otitis media.

Politzer (1) in discussing the bacteriology of otitis media, states that the meningiococcus intracellularis has been found in the secretion from otitis media in cases of epidemic meningitis.

Park (2) states that occasionally we find secondary to a spinal meningitis and due to the micrococcus intracellularis catarrhal affections of the middle ear. The absolute determination of the identity of the micrococcus found in these conditions has not been established, so the above complications can only be considered as probably due to this organism.

Osler (3) in his discussion of complications during epidemic meningitis, states that otitis media with mastoiditis may occur from direct extension.

Horton Brown (4) reports a case of a man 29 years of age, who was suddenly seized with a severe headache and pain in his right ear. The symptoms all pointed to an acute otitis media with slight mastoid involvement. The following morning a rupture of drum membrane occurred with escape of a few drops of pus, followed by relief from intense symptoms. Patient returned to work that afternoon. Early in the evening the headache again returned and the following morning he developed frequent convulsions and was semi-conscious. Examination revealed no discharge from the ear. Both mastoids were opened the left being negative but in the right the bone was found to be very dense, with but few granula-

tions and a slight amount of pus. Previous to the operation a lumbar puncture had been done. The laboratory report, which was received after the operation was completed, showed that the spinal fluid contained the diplococcus intracellularis in large numbers. Following the operation the patient continued to have convulsions, lapsed into coma and died within 24 hours. The post mortem examination showed cerebrospinal meningitis with purulent exudate at base of brain, more marked on the left side.

Sophian (5) states that middle ear infection in epidemic cerebrospinal meningitis is clinically the same as any middle ear infection, but does not appear to be as virulent as other infections. Rarely does it sufficiently affect the mastoid to necessitate operation.

Heiman & Feldstein (6) state that acute catarrhal otitis media is an early and frequent complication of meningiococcus meningitis. They quote Goeppert "as having found it in 35% of his cases during the 1st week, and 75% in the 2nd and 3rd weeks." It so rarely gives rise to subjective symptoms that its presence is likely to be overlooked. Spontaneous perforation of the drum membrane is very rare. In some cases suppuration of the middle ear occurs. Involvement of the mastoid cells is extremely rare.

Roger & Baldenweck (7) report finding only 4 cases of otitis media in 50 cases of epidemic cerebrospinal meningitis treated between January and June, 1915. However, no bacteriological examination was made. They state that it is well known how rarely the meningiococcus causes an otitis, and remark that this is a surprising fact, considering that the habitat of the meningiococcus is in the nasopharynx, and the facility with which the tympanic cavity is affected during the course of other microbic diseases.

These reports would indicate that the meningiococcus is responsible for comparatively few cases of suppurative otitis media, as a complication of epidemic cerebrospinal meningitis. The usual experience of otologists, is that the meningitis is secondary to an extension from a suppurative otitis

media. Thus, in a patient having a chronic or acute suppurating ear, we are prone to follow the usual line of thought in our diagnosis. The experience of Horton Brown and ourselves have strikingly impressed me with the possibility of a meningitis being of the epidemic form, when occurring early in the first week of a suppurating ear, and also, as noted in case one; a meningitis occurring during any stage of a suppurating ear is not necessarily due to an extension from the ear, but may be of the epidemic type.

The very great importance of a bacteriological examination of the spinal fluid, before operating on any case of meningitis, cannot be too strongly insisted upon, even when the circumstances would indicate an extension from a middle ear.

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Discussion.

Dr. Edward B. Dench, New York City, called attention to the tendency on the part of otologists to jump at the conclusion, whenever they encounter meningitis in a patient with a suppurating ear acute or chronic that they have to deal with otitic meningitis. He had had no experience with the type mentioned by the essayist; he had however seen quite a number of cases in which the pneumococcus was found, in which there was absolutely no connection between the otitis media and meningitis. In other words, there was pneumococcemia

in which the pneumococcus infection spread from the blood stream. Many cases were recorded as otitic meningitis in which the meningitis and otitis were merely coincident. He recalled the case of a child, with high temperature and some fluctuation of temperature, in which he opened both mastoids and exposed both lateral sinuses. The sinuses were perfectly clear. The child died eventually of pneumococcic meningitis. In another case, in which the patient went into coma, he could find no macroscopic or microscopic pathway by which the germs traveled. One should be very careful in reporting meningitis as otitic to be sure that the germs come from the ear.

Dr. Don M. Campbell, Detroit, Mich., mentioned the case of a man of 33 years who had been under the care of the family physician for several days on account of a suppurating ear. Two days before he was called in consultation the patient had gone into a state of delirium, presenting opisthotonos, Kernig, and all the other symptoms that go with a frank case of meningitis. Culture made from pus from the ear showed streptococcus infection. Spinal puncture revealed clear fluid under pressure. The laboratory diagnosis was epidemic meningiococcus meningitis. Flexner's serum was used, and the man made a good recovery. The suppurating ear followed a favorable course, the meningitis subsided, and in two or three weeks the patient was perfectly well. He was inclined to agree with Dr. Dench that in many cases the infection reaches the meninges through the blood stream rather than through suppuration in the ear.

Dr. Christian R. Holmes, Cincinnati, Ohio, said Camp Sherman had had a small epidemic of cerebrospinal meningitis, also streptococcic. He recalled a case of acute otitis media with streptococcic meningitis. In two of the cases where spinal punctures were made, the report showed streptococci in the blood. Comparatively few of those who died in the epidemic wards had middle ear complications.

Dr. S. MacCuen Smith, Philadelphia, Pa., maintained that regardless of all efforts to determine whether the meningitis was secondary to the ear infection or the ear infection to the meningitis, one would sometimes fall short of a satisfactory conclusion. He cited a case in which the patient first complained of severe headache. At the end of about a week he complained of pain in the ear, and then had spontaneous rupture of the drum-head. After this and the escape of fluid, the headache was somewhat relieved. After a few days, however, the headache returned and continued for some weeks, when the speaker was called in. He performed a mastoid operation, and the pain was relieved. The second day after the operation, the temperature became normal, the headache was entirely relieved, and the patient was allowed to go out on the lawn. His family were notified that he might return home two days later. The day before he was to return home he suffered from a severe chill. Examination of the spinal fluid showed streptococci. The patient died three days after this chill. He had meningitis of the pneumococcic type. It was very difficult to determine which was the primary site of the infection. Spinal puncture was advised at the time of the mastoid operation, but was refused, the attending physician being one of those who still look upon spinal puncture as a major operation.

Dr. Holmes, continuing the discussion, said his experience had been similar to that of Dr. Pierce in the matter of serum treatment. There were now, under the new classification, seventy varieties of the meningiococcus. It was impossible to strike all of these with a serum. While now and then a case might be found in which the antistreptococcic serum would do good, too much should not be expected of it.

Dr. Dench, continuing the discussion, mentioned two cases of meningitis which had been suspected to be of otitic origin, in which, when the patients died suddenly, the sphenoids were found filled with pus. In another, in which there was no avenue of infection from the middle ear to the meninges the

sphenoid was infected. It was thought that the meningeal infection came through the sphenoid.

Dr. Holmes added that what had been considered pus in the accessory sinuses after death might be serous exudate.

Dr. S. MacCuen Smith, Philadelphia, had used as high as ninety grains of urotropin injected into the spinal column, without any benefit whatever. He felt justified in making the statement that Dr. McKernon, who at one time used this method of medication very extensively, had entirely abandoned it.

A CASE OF MENINGITIS TREATED BY LABYRINTHECTOMY AND DECOMPRESSION.

By CHAS. E. PERKINS, M. D., F. A. C. S., New York, N. Y.

The patient whose case is the subject of this report was a young man seventeen years of age, a private patient of Dr. Dench who came under my care in the Plant Pavillion at St. Luke's Hospital on July 7, 1917. He had had a purulent discharge from his right middle ear for a number of years following measles in childhood. This apparently ran without complications until early in June i. e. about one month previous to admission. Then he had developed vertigo and a facial paralysis on the involved side. About two weeks later a radical mastoid operation was done in a neighboring city. He did well after this interference and was discharged from the hospital on the tenth day. His vertigo had disappeared and the facial paralysis had nearly cleared up.

On July 4th, three days before I saw him, he was taken with a severe headache and fever, both of which symptoms continued until his admission to the hospital, at which time he was moaning with the pain in his head and throwing himself about with some violence. His temperature was 102° the neck was stiff and he was mildly delirious although he answered questions readily. Hearing in the right ear with noise apparatus in left absent. Caloric reaction negative on right side, no spontaneous nystagmus or overpointing.

It was thought that there could be no question but that he had meningitis following suppurative labyrinthitis, nevertheless his spinal fluid showed a leucocytosis of 15 cells, 12 of which were polymorphonuclears, butyric test mildly positive. Culture of this fluid afterwards proved to be negative. On account of this spinal fluid report although meningitis seemed clinically present operation was deferred.

On the following day his symptoms were no better and the report on the spinal fluid was 512 cells to the cubic millimeter so I determined to operate. Operation: Old radical cavity exposed by posterior incision and cleared of granulations. Lateral sinus exposed. Bone removed from Trautmans triangle. Posterior semicircular canal opened and removed, also posterior end of horizontal. Vestibule entered from behind. Dura in internal auditory meatus exposed, as also was that in the middle fossa well up beneath the squama. The dura in the posterior fossa incised from about the middle of the internal auditory meatus to near the lateral sinus. Cerebellum bulged into the incision. Small folded rubber tissue drain inserted. No marked amount of spinal fluid escaped. Crucial incision of dura in middle fossa. Some escape of spinal fluid; marked, bulging of brain through incision.

The following day the 9th, the temperature fluctuated between 101° and 104°, spinal fluid cells 2000. Butyric positive. 10th, Temp. 103° to 104.8°. Spinal fluid 3500. Butyric test positive. Smear gave many pus cells and a few gram positive diplococci. Slight opisthotonos. Wound redressed. Brain tissue of temporosphenoidal lobe sloughing with foul odor. Dakin's Solution was used at the suggestion of Dr. Dench. The wound was lightly packed with gauze, soaked in the solution, surrounding two rubber tubes which were allowed to protrude from beneath the dressing. The ends were covered with pads of gauze which were removed every two hours for the installation of the Dakin's Solution.

11th. The odor of the wound much less; temperature 101° to 103°; opisthotonos so extreme that lumbar puncture was unsuccessful. Patient appeared stronger and slightly better mentally. From this time on improvement continued. The wound rapidly grew better under the Dakin's Solution which was continued for about three weeks. The brain hernia became very much reduced in size and became covered with healthy granulations and epithelium. The brain prolapses had divided the posterior opening from

the radical cavity, the latter dermatized over leaving a dry ear. A small posterior sinus persisted which nearly became dry, eventually discharging but a drop or two of pus in 48 hours. This seemed to lead to the region of the internal auditory meatus and was believed to be due to some slight amount of bone necrosis.

He left the hospital August 24th, one month and sixteen days after the operation apparently in fine condition. About three weeks after this the upper wall of the radical cavity prolapsed, evidently from pressure of fluid, the ear, however, remained dry for another three weeks when a serious discharge began and continued until death. He also began to complain of headache and vomiting.

He was readmitted to the Hospital on September 26th. The reports on lumbar punctures were as follows:

September 26. Leucocytes, 15; lymph, 100%; Butyric culture 0.

October 4. Leucocytes, 10; lymph, 100%; Butyric Wasserman negative.

October 9. Leucocytes, 7; lymph, 100%; Butyric culture 0.

October 17. Leucocytes, 8; lymph, 100%; Butyric.

October 18. Fluid bloody.

His eye grounds were negative. A neurologist went over him and discovered nothing. Dr. Hollis treated him for an acidosis by lavage and sodium bicarbonate without much beneficial effect on his symptoms although his urine which had contained acetone and diacetic acid on three successive days showed improvement.

Earnest solicitation failed to obtain permission for further surgical intervention. He became comatose and about 36 hours later died October 20, 1917. No autopsy was allowed.

Several points about this case seem worthy of mention. This patient, following a suppurative labyrinthitis, associated with facial paralysis, which passed into the latent stage, developed meningitis. There seems no valid objection to assuming that the route of infection was through

this dead labyrinth. The peculiar feature is that for three days there was intense headache, fever, stiffness of the neck, etc., in fact a clinical picture of meningitis and yet the spinal fluid showed but 15 cells to the mm. Twelve of these were however polymorphonuclear. I did not at the time feel justified in operating with this count even though meningitis seemed, from the symptoms, to be present. About 20 hours later as the report from the laboratory was 512 cells to the mm. I did not hesitate but did the labyrinthectomy with cerebellar and subtemporal decompression. The question arises should I not have operated with the symptoms present together with a spinal fluid count of 15, 80% of which were polymorphonuclears. My opinion is I should.

Two days after the operation the brain was sloughing and foul smelling, altogether a mess. The effect of the Dakin's Solution was marvelous, judged from the old standards. The brain became firm and healthy and dermatized over. There was, however, so much sloughing of the cerebral substance that the lateral ventricle must have approached the radical cavity and the pressure of the cerebrospinal fluid caused a prolapse of the superior wall with seepage through the ear. This was not in sufficient amount to cause headache or did death result from reinfection of the meninges as the spinal fluid remained clear throughout. The exact cause of death is to me obscure. The fact that it was not meningitis leads me to claim a cure from that disease although the patient died three and one-half months later from some other condition.

Discussion.

Dr. E. B. Dench, New York City, emphasized the point that in dealing with meningitis which had come from infection through the internal auditory meatus, the best results were obtained by attacking the infection at the point of entrance—the internal auditory meatus. The extension of the wound into the region of the squama and making it

continuous with subtemporal decompression wound was good surgical practice in these cases. In dealing with meningitis not definitely known to be of otitic origin, particularly with no labyrinthine symptoms, he agreed with Dr. Randall's suggestion as to the advisability of going through a clean area. He had seen no mention in the literature of the use of Dakin's solution in this particular area. Dr. Perkins' observation was unique.

Dr. Perkins, in closing the discussion, did not see how, in a case with this condition, it would be possible to operate through normal tissue and leave an aseptic field, in removing the source of infection. If the labyrinth was infected it must be removed, and if the infection was through the internal auditory meatus it must be opened. The object of the operation was to remove the localized process before it became general. He knew of no way of telling that the process was localized other than by the general symptoms and examination of the spinal fluid.

REPORT OF A CASE OF MASTOIDECTOMY FOR ACUTE SUPPURATIVE OTITIS MEDIA, FOLLOWED LATER BY FACIAL PARALYSIS, ALMOST TOTAL DEAFNESS, MENINGITIS AND DEATH.

By JOHN RANDOLPH PAGE, M. D., New York, N. Y.

In this case, the brief report of which follows, a facial paralysis began to develop three days after a simple mastoid operation, and in two days it was complete. Seven days after the operation there occurred suddenly with vomiting and tinnitus, but apparently without nystagmus or vertigo, total loss of hearing in the opposite ear, and it was then noticed positively for the first time that there was almost total loss of hearing on the operated side. A high leucocyte count and cloudy cerebrospinal fluid were present, with a mental condition that remained unimpaired almost to the last day.

A delicate boy, ten years old, had a simple mastoid operation performed on his right ear in May, 1918, from which he made a good recovery. He was unusually bright and sensitive, and not robust, though he had improved in health during the past two years. On the twenty-sixth of January, 1918, eight days after the development of an abscess in his left ear, he was seen by the writer for the first time since the operation two years before. At this examination his temperature was 103 by mouth and he complained of severe headache. His mastoid was acutely tender, with a profuse characteristic discharge from the middle ear and marked sagging of the postero-superior canal wall. Immediate operation was advised and consented to.

A thin darkened cortex was removed with a rongeur, and a pneumatic mastoid was found filled with pus, culture from which showed hemolytic streptococcus. The cells were involved behind and internal to the facial nerve, but no exposure of the nerve was made. What appeared to

be healthy dura was exposed in the region of the attic and antrum, and the sinus was exposed over its vertical limb. The exposed sinus wall on the seventh day after the operation, when the temperature rose to 104°, still had no granulations over its lower part, and it looked as though infection might be passing through it, but in the next day or two it showed a healthy appearance, and the blood culture was negative.

The patient was comparatively comfortable the day after the operation, though his temperature at 9 a. m. was 103° by rectum. During the next eight days the bedside notes are of interest, showing what may have been an invasion of the meninges along the left facial nerve with little or no disturbance of the static labyrinth and the gradual development of a basilar meningitis which caused total loss of hearing in the opposite ear and death a few days later without impairing the mental condition of the patient until almost the very end.

January 28—second day after operation. Temperature ranged between 100° and 101°. Patient felt nauseated and vomited small amount of clear fluid. Urine showed presence of acetone and diacetic acid. Bicarbonate of soda and ice water were administered by mouth and bicarbonate of soda and glucose by rectum. Vomiting ceased.

January 29—Temperature ranged from 98.6° to 100.2°. Rested comfortably. Full dressing was done under nitrous oxide anesthesia. A slight paresis of the muscles of the left side of the face was noticed. Acetone and diacetic acid were no longer present in the urine. Patient cheerful. No evidence of vertigo or labyrinthine disturbance.

January 30—Temperature ranged from 99.2° to 101°. Fairly comfortable morning. Later complained of headache. Paresis of facial muscles increased. Wound showed considerable purulent discharge. Dakin's solution was instilled in the wound through a tube every two hours. Sat up in bed.

January 31—5th day after operation. Secretion in wound less. Dakin's solution discontinued. Temperature ranged

between 98.2° and 100.6°. Comfortable day. Slight headache at night. Facial paralysis practically complete.

February 1—6th day after operation. Temperature ranged from 98.2° to 101.2°. Vomited slightly at 8 a. m. and complained of slight headache. Had fairly comfortable day, however, and retained his nourishment.

February 2—7th day after operation. Complained of slight headache during the night. Temperature at 6 a. m. was 102.6°. Vomited at 6:30 a. m. Vomited small amount of greenish fluid at 7.30. Up to this time there was apparently no difficulty in hearing. At 9 o'clock he vomited clear fluid. At 10.45 he was visited by me and was found sitting up in bed. As soon as I entered the door he called out in a loud voice, "Good-morning, Doctor," and shouted that he had a roaring in his right ear and could hear nothing. It was apparent that he could not hear the sound of his own voice. The nurse was asked how long he had been deaf and she replied that she had only just noticed it, that he had been able to hear her well a short time before. A blood count was taken that morning which showed 42,000 leucocytes and 90% polynuclear neutrophiles. Blood culture taken at the same time was negative, urine was normal and eye grounds were normal. Mental condition was bright. Drs. Duel and Mixsell were in consultation. Lumbar puncture was done by Dr. Dwyer at about 3.30 in the afternoon when the temperature was 103.8°. The cerebrospinal fluid was cloudy but no bacteria were found on smear or culture. Lactic acid was present and sugar was present. There was pain in the back of his neck and between his shoulders but there was no marked rigidity or very evident Koenig sign. Headache was intense in the morning but after lumbar puncture patient slept well and said he felt better and had hardly any headache. The temperature was 104° and pulse 90 at night. Condition was improved except for the high temperature. There was no further record of vomiting until the afternoon of the following day.

February 3—8th day after operation. Temperature

ranged between 101.2° and 103.8°. Pulse from 84 to 104. Blood count 44,000 leucocytes and 89% polynuclear neutrophiles. Eye grounds were examined and found normal. During the dressing the patient remarked that his hearing was much better when the dressing was off the right ear. In the afternoon vomiting and headache returned. At 1.30 a. m. he complained for the first time of feeling dizzy and vomited immediately a small amount of dark fluid. During the night he asked for some cherries and was allowed several which he retained. There was no apparent change in his mental condition but in voiding urine he seemed unable to sit up as usual. He slept quietly all night and some of the time turned on his affected side.

February 4—9th day after operation. At 6 A. M. his temperature was 103°. He retained some orange juice. At 7 A. M. he complained of being hungry and ate a little cereal and milk. At 9 A. M. he had a temperature of 103° and complained of shooting pains in his forehead and later pains in his head and spine between the shoulders. At noon his temperature was 103.8° and he was very thirsty. At 1.30 he vomited a large amount of undigested milk. At 2 P. M. he voided urine in bed. An hour later he became noisy and screamed with pain. He was quite rational. His temperature in the afternoon was 103.6°, blood count 47,600 leucocytes and 88% polynuclear neutrophiles. At 6 P. M. he was quiet and rational. Vomited small amount of clear fluid. During the night he vomited several times, complained of intense thirst and was irrational at times.

February 5—10th day after operation. Patient had typical meningeal cry. Rational only at times in the morning. Temperature dropped from 104° at 6 A. M. to 100.2° at 3 P. M., and at 6 P. M., two hours before his death, temperature was 104.4°.

No autopsy was obtained.

From the second day after the operation until two days before his death, the patient frequently sat up in bed and showed no loss of equilibrium. While until the last there

remained a slight amount of hearing in the left ear, it was only for very loud sounds, and words could not be distinguished except on one or two occasions when the dressing was off. There was sudden and total loss of hearing in the right ear.

An interesting point to decide is, whether this was a labyrinthine deafness or a retrolabyrinthine nerve deafness. The sudden loss of hearing with roaring tinnitus and vomiting leads one to think first of the labyrinth, but when it is recalled that from first to last the patient was at all times able to sit up without disturbance of equilibrium it seems improbable that any destruction of the labyrinth could have taken place. For while a simultaneous obliteration of both labyrinths might occur to cause total deafness without nystagmus, such sudden destruction would necessarily be accompanied by some very evident disturbance of equilibrium.

The conclusion reached is that meningitis was the cause of the persistent vomiting and deafness, and not disturbance of the labyrinth, and that invasion of the meninges very likely took place in this instance along the route of the facial nerve.

Discussion.

Dr. Geo. E. Shambaugh, Chicago, Ill.: The interesting question in this case is to account for the sudden destruction of the function of the internal ear without that disturbance of equilibrium and nystagmus which we associate with this phenomenon. The occurrence of disturbances of equilibrium and nystagmus after a sudden unilateral destruction of the internal ear is accounted for by the continuation of the tonus impulses from the normal ear acting without the restraint of the opposing tonus impulses from the affected side. Where a patient has already suffered from a suppression of function of the vestibular mechanism in one ear, it would seem that a sudden destruction of the opposite side could take place without the symptoms of disturbed equilibrium and nystagmus, for the simple reason

that there are no opposing tonus impulses from the opposite side to produce these reactions. In the same way a patient who suffers from a sudden complete destruction of the function of both internal ears simultaneously should not exhibit the phenomena of vertigo and nystagmus. The loss of tonus from the two sides will produce a loss of muscle tonus, but not vertigo.

Two things seem possible in Dr. Page's case to account for the absence of disturbed equilibrium from the sudden suppression of function in the opposite ear: one is, that the function of the semicircular canals had already been destroyed in the operated ear; and the other is that the sudden destruction of the hearing function in the unoperated ear might have occurred, say as the result of an embolus lodged in the cochlea, without interfering with the function of the semicircular canal apparatus. When the opportunity presents, it would be very interesting to make careful observation of such cases as this for additional light on the function of the internal ear.

OTOLOGIC PROBLEMS FROM THE STANDPOINT OF AVIATION SERVICE.

By LIEUT.-COL. EUGENE R. LEWIS, Medical Corps, U. S. Army.

One year ago, when Major Lyster was assigned to the Herculean task of organizing the members of this Society and allied bodies in this work, the response, as you know, was unanimous and whole-hearted. Within a very few weeks after adjournment the work of the selection of men to be trained as flyers was well under way and the medical man in uniform and out of uniform went into it with a spirit and effectiveness for which it would be difficult to find a parallel. On this, the first anniversary of that service, it is particularly fitting that we should attempt to make some kind of a report to the Societies as to what has been done and what we hope to continue to do, and to make a special acknowledgement of our appreciation of the co-operation so uniformly met with at the hands of members of this Society.

In October of last year some of our medical officers were sent abroad to study medical problems connected with the air service, and they were able to carry out very valuable investigations in the matter of making comparisons with the methods applied by other air services and our own. They were imbued with the spirit of bringing back anything which would improve the medical air service in this country. The result of that comparison was to leave them under the profound conviction that the medical air service of the United States had probably no superior in the air service of the Allies. As to what Germany has we do not know.

Whereas, it is possible that some few men may have applied for air service in this country and been rejected who might have been physically adequate for the service, it is fair to state that practically none have been admitted who are physically unfit for that service.

The medical work does not stop with the selection of the

raw material. We must make absolutely certain that the material is standing up. The experience of our allies early brought to light that there is great variation in individuals as to their ability to withstand the special stress to which a man in the air is subjected; furthermore, that there is great difference between individuals of apparently the same physical equipment. The man in the air developes acute physical deterioration, sometimes to the point of unconsciousness. Yet two men of apparently the same physical equipment will not develop the same physical deteriorations.

In addition to this acute deterioration there is a chronic deterioration which is applicable to all air men. This is called "air staleness."

It is necessary to consider especially the difference between ground atmosphere and that in which the air fighter must work. The ground fighter fights in his accustomed atmosphere as far as oxygen content is concerned. All the aviator's fighting is done at altitudes at which less oxygen is a big factor of atmospheric difference.

The wise thing is not to learn in the way the pioneers abroad had to learn, by trying the men out in the air,—it is much more economical, much more scientific, and much more rapid, to test aviators out on the ground. By reproducing artificially the same conditions they encounter in the air it is possible to determine the differences in individuals as to low oxygen tolerance. That, therefore, shapes itself up as a very important part of the service which the medical man can render to the forces of the country.

The cardio-vascular and some of the special sense tests have been codified into standard tests which are used to classify men as to physical fitness at different altitudes. The Allies learned that some men are not at all adapted to become high flyers; other, satisfactory as day flyers, but not suitable for night flyers, where certain ophthalmological differences exist. By accurate tests, under artificial conditions, it is possible for the medical man to rate a man as not adapted for night bombing work, etc. The flight commander, furnished with accurate information concerning the men of his command,

can then select those men particularly equipped for the service to which they are to be assigned.

After accomplishing the selection and the classification there must be no breaking of the touch between the medical man charged with the selection of the material and the man who has passed through his hands. This keeping in contact is perhaps the most important part of all. If we should take the stand that we have selected and classified the raw material and know that it is well done and that further medical supervision is unnecessary, we would fail. The maintenance of the flyer's physical efficiency has been carried out by what we are calling "flight surgeons." These specially trained medical men have been gathered together and sent out to the different fields, where it is their duty to keep in as close touch as possible with the flyers. If the medical man could eat and sleep with the man all the time he would not have too much opportunity to study the flyers in combat, because these air ills are new. There is great need for specially trained men out in the field to detect the first signs of the onset of these special ills of the flyer.

The Maintenance Service is further aided by the addition of the old experienced empiric, the football trainer who is a very acute observer. He is to go into the field with the flight surgeon to live with the boys and to know just how they feel. A boy may not feel just like flying a certain day, and he will hesitate to go to the surgeon and say, "I do not feel like flying today," for fear he would be suspected of a "yellow streak." Many accidents have been the result of this. Through the Flight Surgeons and physical directors, then, the maintenance department is doing all it can to maintain physical efficiency in the flyers.

The Air Medical Service may be summed up in:

1. Selection of the flyer.
2. Classification of the flyer as to physical fitness for special duties.
3. Maintenance of the flyer's physical efficiency.

AVIATION MEDICAL SERVICE HERE AND ABROAD.

By THEODORE C. LYSTER, Brigadier-General, Medical Corps, U. S. A.

It is now just a year since we were all assembled here facing the beginning of our part of the war. If you will remember, two problems were uppermost in our minds at that time. (1) How to utilize the men who had specialized in medicine so that their special services would not be lost by placing the round peg in the square hole. How this has been accomplished you are in a position to judge. (2) How to organize an efficient aviation medical service. As it exists today there is a large number of medical officers and enlisted personnel of the Medical Department serving with the Air Service.

It is the desire here not to try and treat the whole problem of the Aviation Service, but to take up the vital care that should now be given to the individual aviator if we wish him to fulfil our expectations for him when flying over the lines. It is my desire to briefly but clearly bring to your mind what has been forcefully brought to our attention while recently in France as to the need of special medical care for the aviator. An opportunity was given both Major (now Lt. Colonel) Isaac H. Jones and myself by the commanding general to see what is actually being done by Great Britain, France and Italy towards maintaining an efficient flying force. It is now our desire to have you look beyond the building of machines and the enlisting of men for the aviation service and go a step further into a development which is even more recent than the art of flying. It is one thing to build machines and train men to fly in them; but another to maintain these men and machines in the air by the constant supervision necessary. This is a far-reaching problem which is intimately involved in the evolution of the air service, and largely falls upon the medical service to keep these fliers at their greatest efficiency.

Bear in mind three general sub-heads under which the Medical Division of the Aviation Section were reaching out to help to send over the top the maximum number of fliers and to send them in the best physical condition to accomplish their purpose. After all, it is the human machine that controls the situation. France today mourns the loss of many of her best fliers, which she describes as "Aces." Great Britain has suffered in a similar way, and has taken a decided stand in specially protecting her fliers while on the fighting line. She now realizes that her Honor Rolls, which are usually hung up in each Squadron Headquarters, are too often a measure of failure, not of the aviator but of those responsible for his fitness at the time of his crash.

The three sub-heads are:

First, the selection of those suitable for flying;

Second, their classification from a medical standpoint for duty with observation squadrons, fighting squadrons, day bombing and night bombing;.

And, Third, the maintenance of each aviator at his maximum efficiency.

What we have done or are trying to do I will try to describe briefly.

In the selection of prospective fliers the medical division has been able to carry out their physical examinations by trained examiners in different centers throughout the United States. Thousands of men have been examined, from whom were selected a body of men who today, physically, have no equal in this or any other country. And, further, we have enough to lend our allies a considerable number should they need them.

Having now aided in this selection of aviators, it has been found that our real work has just begun. These men are either in France or in this country, actually flying or undergoing instruction. It is not enough nowadays to simply be a normal man to fit you equally well for the different types of flying now demanded. High as the standard has been, we now realize from the work abroad that we can go a step further and determine just what type of flying an individual

is physically best fitted to perform. The question that confronts us is how it can be determined as early as practicable just where each pilot belongs. Certainly not by guess work, individual impressions, nor the fact that a pilot does not return after a flight.

It is fully realized that the final test comes in the air, but it is even more fully realized that the first test should not be in the air but by the most careful examination possible as early in the course of training as it can be carried out. As an example: to make a pilot with a poor light sense (his vision otherwise normal) fly at night is suicidal; equally so to compel him to do altitude flying when it can be shown to a certainty that he will faint on reaching ten to twelve thousand feet. If these pilots were properly classified, the man with the poor light sense but otherwise normal should and would be able to do satisfactory service as a day bomber; the pilot who, otherwise normal, could not fly at an elevation beyond ten or twelve thousand feet, might well be able to do efficient service in an observation plane which is not intended nor able to ascend to these altitudes. These examples are mentioned to direct your thoughts as to how very practical research of this character can be made.

Finally, it is not enough to select a flier and then to classify him unless you are going to maintain him at his maximum efficiency. It is here that the trained medical man, as an adviser to the commanding officer of each aerodrome or flying school, can give that same close supervision to the human machine that he is now giving to the aeroplane itself. In 1915 there were many accidents to the Royal Flying Corps due to physical defects of the pilots. When this became known the physical entrance requirements were made more rigid. The rate fell rapidly in 1916 and still further in 1917. No country can afford to sacrifice its fliers when due to preventable causes.

In order to carry further this maintenance of the efficiency of every flier in the Air Service, authorization was obtained for the creation of the position of flight surgeons and physical directors. A flight surgeon is a medical officer whose duties

will be to have charge of all that pertains to the physical well-being of the cadet flier. Many of the flying schools have already been provided with flight surgeons. Medical men to fill these positions are most carefully selected with a view to their special fitness for a class of work which requires good medical training, excellent judgment and special knowledge of the medical problems involved in the flying service. After selecting prospective flight surgeons they are sent to the Medical Research Laboratory for intensive training and then to a flying school. Before long, every flying school will have a flight surgeon.

The physical directors are being selected from the well known coaches, physical directors and trainers of our various colleges. These directors are taken in as First Lieutenants in the Sanitary Corps, sent for a short time to the Medical Research Laboratory for a special course, and then on to the flying schools. Their duty will be as an assistant of the flight surgeon in everything that relates to the physical training of prospective fliers, and to occupy a similar position to the flier to that occupied in athletic tests in the various universities from which they came.

You will see from the foregoing that the personnel of the flying schools will be treated very much as an athletic section of a university, with the flying instructors acting in the capacity of the coach, the flight surgeons as athletic directors, and the physical directors as physical directors or trainers. It is the purpose to so regulate the lives of the cadet fliers that they will be in good condition at all times, neither to be undertrained nor overtrained. It is realized that the game to be played is not one of a day or a season but of years, and their condition must be made to conform to this extension of the time limit.

It is proposed to have the Food Division in the Surgeon General's Office supervise the diets at the flying schools. The importance of the training table is too long established in connection with our various athletic teams to require any urging on my part of its great need.

Early in the organization of the Medical Department

assigned to duty with our air forces it was seen that many of the problems would require a very efficient research board to help to solve them. Such a board was created about a year ago and has now extended its functions by establishing laboratories at many of our flying schools. The main laboratory will naturally do most of the research; the branch laboratories will be largely concerned in classifying our fliers.

The above sketch has been given with a view to presenting in a brief way the special medical features involved in the flying service, which is entirely different from other branches of the military service. Because of these differences the Medical Department assigned to duty with the Air Service naturally had not only to meet the usual difficulties involved in caring for a body of troops, but had these special and unknown problems in addition. Our losses from accidents in the air so far have remained small. It is expected that the medical organization will not only be able to lessen these but will prove invaluable on the other side where our fliers naturally have to operate under most exhausting conditions.

A NEW TEST AND METHOD OF CLASSIFICATION FOR LABYRINTH, MUSCLE TONE AND BLOOD PRESSURE FINDINGS IN MEN ENTERING MILITARY AVIATION SERVICE. PRELIMINARY REPORT.

By CHARLES MOORE ROBERTSON, B. S., A. M., M. D., F. A. C. S.,
Captain Medical Reserve Corps, U. S. Army.

At this time, the United States is stirred to its utmost to prepare an army, and we realize to make most of our opportunity we must mass troops of air fighters, believing that they are more serviceable and more mobile than any other type of offensive or defensive. For this reason it has seemed wise for our directors to formulate an aerial army who will be as near perfect as can be, and who will be able to strike as terrific a blow as possible. To do this the government has realized that much of the work will be individual fighting, although later we may develop into mass formation, such as we know and do on the earth's surface.

At this time we are in a movement of assembling thousands of men who will be able to vie with the birds of the air, and we as aurists are called upon to search out men who are particularly adapted to this line of duty.

To be an aviator, as the government sees it, a man must be almost perfect, which means he must be physically qualified, his eyesight normal without glasses, and his static ear must respond to the regulation tests for nystagmus, past pointing and falling. This gives us an aviator who is a perfect type of man as he stands on the earth's surface, but is this enough?

The duties of an aviator are for patrol, for scouting, mapping, photographing, communicating with field artillery in range finding, as well as for fighting other aircraft.

For the ordinary close to earth maneuvering the man does not require to be so finely adjusted, for he is in a medium

of air, almost the same in density and condition as that on the earth's surface. This does not hold true, however, for the aviator who ascends to more than a thousand feet, as when he has attained a greater altitude he experiences varying conditions of density and temperature, which change in a direct and fixed ratio at the different levels. Were it the practice of aviators to ascend and descend at any given altitude, at a moderate rate of speed, he might not have to be chosen with so much care, but we know he must change his altitude suddenly, and in many instances to a great amount, so he is subjected to violent variations of temperature, and especially air pressure, sometimes in a few seconds time. To consider this phase of aviation is the theme of this paper.

In order to understand the meaning of atmospheric influence, it is necessary to determine the difference in air pressure at the several altitudes. (See chart.)

DETERMINATION OF HEIGHTS BY THE BAROMETER.

Values of 60368. (1 plus 0.0010195 x 36) log. $\frac{29.90}{B}$

Barometric Pressure. Inches.	M.M.	Altitude. Feet.	Barometric Pressure. Inches.	M.M.	Altitude. Feet.
11.00	286	25900	21.50	559	5964
12.00	312	24814	22.00	572	8339
12.50	325	23704	22.50	585	7728
13.00	338	21612	23.00	598	7131
13.50	351	20624	23.50	611	6546
14.00	364	19674	24.00	624	5974
14.50	377	18749	24.50	637	5414
15.00	390	17858	25.00	650	4865
15.50	403	16995	25.50	563	4326
16.00	416	16158	26.00	676	3799
16.50	429	15347	26.50	689	3281
17.00	442	14559	27.00	702	2773
17.50	455	13793	27.50	715	2274
18.00	468	13049	28.00	730	1784
18.50	481	13049	28.50	743	1303
19.00	494	12324	29.00	756	831
19.50	507	11618	29.50	769	366
20.00	520	10930	30.00	672	—91
20.50	533	10259	30.50	685	—540
21.00	546	9604			

Smithsonian Meteorological Tables, 3rd rev. ed., 1907. Pages 100-3.

It will be noted that the pressure of the air at sea level is about 14.7 pounds per square inch. At 20,000 feet altitude the air pressure has been reduced to less than one-half the earth's surface pressure, and at 30,000 feet it has fallen to about one-fourth the pressure at the earth's surface.

Motor manufacturers have had to recognize this fact in the equipment of carbureters furnished airplane machines, for it is necessary to have a regulating device to feed three times the amount of oxygen into the petrol mixture at 15,000 feet, that is required at the earth's surface. The temperature at 25,000 feet altitude is far below zero (F.) while the sun's rays register near 140° F. Thus the aviator may have his feet frozen, and his face, were it exposed, blistered from the sun's rays. As we ascend, the content of the air is not changed, but the oxygen tension is diminished; at 16,000 feet it being only 25 per cent. of the tension at the earth's surface. *1.

Should we attain great altitude, therefore, it becomes necessary to make use of an oxygen mask to be able to carry on proper aeration of the blood.

Our government is now supplying a device by which oxygen is fed to the engine and to the aviator automatically, as the altitude becomes greater, and which diminishes the oxygen supplied as the altitude becomes less.

Most men do not experience much change going from a denser into a rarer medium which occurs in ascent, but when traveling rapidly from a rarer into a denser air, some very striking symptoms are produced, which vary in degree from slight vertigo to syncope and at times motor paralysis.

When we remember that the aviator is the eye of the army, we realize how important it becomes for him to return to his base and should he fail to do so, we can at once see the embarrassment of the land or sea forces without the knowledge he would supply.

Our whole army at this time realizes that it is necessary to have men selected for this work who are, so far as possible,

*1. Report of Med. Research Board. The Military Surgeon. February, 1918. P. 146.

perfect: that the life of the aviator is all important; that he may return with information or be able to communicate information constantly, which information determines the maneuvers on the earth's surface or on the sea; that his photographs are absolutely essential, and that one man in the air is equal to a whole division on the ground.

Aviation, as we know it today, is advancing so rapidly that to keep pace with its progress requires daily application in order to grasp the ever-increasing technique, both in the construction of motors and planes, as well as the art of flying through air.

When the war began a machine capable of sixty miles per hour was considered all that we could look for, and the ascension to 10,000 feet altitude in half an hour was considered wonderful.

In order to leave the earth's surface, the aircraft was required to gain momentum by running on the ground for several hundred feet before it was able to take to the air. At the present time, the machine must be able to leave the ground almost immediately and must be able to climb at the rate of 1,000 feet per minute.

It is useless to try to cope with aircraft which is faster than the attacking machine, and it would be impossible for the aviator to get away if his plane travelled slower than the machine of his adversary. It thus is evident that we must have extra fleet machines, if we are to be masters of the air, for no matter how expert our pilots might be, they would be helpless in planes slower than those of the enemy. It is not only faster machines which we must have, but it is equally important to have superior men in these machines, that they may outmaneuver the enemy and thus bring him into the range of gun fire. To meet this requirement, it is necessary to have men operators who are mechanically and physically fit. They must have good respiratory organs, open Eustachian tubes, and a perfect ear with normal vestibular apparatus, as well as a perfect body. To this end the government has conducted very rigid tests of the aviator applicant. The vestibular tests have been carried on to show

that each man has a normal labyrinth as confirmed by rotation tests.

It has occurred to the author that these examinations, as they are being made, were not enough, nor of scope enough, as they show nothing of the condition of the applicant in actual flying, and it is with this idea in view that I have directed my attention in the following work. This work, so far as I know, is entirely new, and, therefore, what I expect to prove is at present rather speculative, although we have made a prediction of that which we shall expect to find, which is given in a part of this paper.

To have a sound body and a normal vestibular apparatus is well enough, but clinically we know that some people who have all this are subject at times to dizzy spells, seasickness and faintness or syncope, when subjected to motion or air pressure changes such as we would get in the act of flying. This, of course, is not common, but occurs nevertheless in some. With this thought in mind, it occurred to me that some sort of test should be made to simulate actual conditions met in flying and the results determined.

Aviators do not have simply to fly in their machines, but they are required to do evolutions in order to escape from, or gain advantage of, their adversary in the game of war. No matter how expert a man may be with a machine gun, he would be powerless in combat unless he be able to outmaneuver his adversary in reconnoitering, so he can bring himself into a vantage position to get *"on the tail"* of his opponent and thus be able to get his machine gun into effective operation. In order to gain this advantage, it is necessary for the aviator to do trick flying, which means he must be able to ascend and descend very rapidly, do irregular motions, thus making his adversary believe he is disabled or killed. He does this by falling as though hit or out of control. He must be able to drop, irrespective of plane position, for several thousand feet, if necessary, and be able at a given moment to *"flatten out"* so he can loop over or under his opponent and bring up on his adversary's *"tail"* under and behind him.

In subjecting himself to these motions and traveling through

the air at such terrific speed, forward, upward or downward, he is subjected to violent variation of atmospheric pressure conditions, and it is obvious that he should be tested as to his ability to resist these sudden changes so he may not lose his equilibrium or motor power from sudden changes in air pressure. To judge the ability of an applicant for this service, we should test him in some way which simulates as near as possible an actual flight with such maneuvers.

In order to obtain this information without actual flying as a test, I have devised a cabinet, which meets the requirements in all particulars.

The object of attempting this series of experiments was suggested to me by the reports which were constantly printed in the press under war telegrams, stating that a certain number of planes were shot down in combat, while others went down out of control. It appeared to me that there must be a reason why so many fell out of control, not from any damage done by the opponent, but rather from some cause in the man himself who fell to his death.

I have learned, since beginning my experiments, that 50 per cent. of the falls show there was nothing faulty with the engine and the plane had no marks of being hit, nor had the aviator received a wound from his adversary.

It is thus shown that one-half of the fatalities in aviation are due to a cause other than those we term "*effects of combat.*"

If we consider the causes which may produce a fall of an air plane, we might divide them into two classes:

First. From fault of the machine.

Second. From fault of the operator.

First. From fault of the motor, a fall may occur from:

(a) The plane may have remained in the air too long by an extended flight and have exhausted the supply of petrol (this is not often productive of a fall as the pilot can volplane to the earth and land safely).

(b) The motor may have become fouled by faulty or worn machinery or connecting parts.

(c) The motor may have been hit and thus put out of commission.

(d) The steering gear or plane, or planes may have been shot away.

(e) The petrol tank may have been hit and set afire or exploded.

Second. From fault of the operator a fall may occur from:

(a) The operator may have been killed or injured making it impossible for him to work the steering gear of his machine.

(b) The operator may have become entirely exhausted.

(c) The operator may have become dizzy from the change of air pressure and the vertigo severe enough to have him lose control of his plane.

(d) The operator may have lost his motor-power from great atmospheric pressure changes.

(e) The operator may have become unconscious from hemorrhage into the labyrinth or from heart failure.

To ascertain if any of the causes under the "Fault of the operator" can be detected, is the object of the experiments I am conducting, and to find a remedy, so far as the army aviator is concerned.

In subjecting men to this test, it is necessary to examine them in the same way, both before and after, he has been subjected to the test, so a comparison of the findings may be had. He therefore is subjected to the regular physical tests for blood pressure, pulse, muscular tone and rotation.

In testing the heart, I have taken both the systolic and diastolic pressures, and the rapidity of the pulse. The muscle tonus is taken by the dynometer for sixty pounds pressure and is represented by the number of seconds the pressure can be sustained by a single nerve impulse for both right and left hands. Fig. 1. His turning test for nystagmus is done the same as in the present army test for the horizontal canal

Fig. I. Dynometer Test for One Motor Impulse in Number of Seconds.

and is given in the number of seconds the nystagmus persists. Fig. 2.

The past pointing is also given in seconds for each hand instead of the number of times he points incorrectly, which gives us a better value to the amount of past pointing.

After this examination, the applicant is placed in the cabinet and air exhausted at the rate of 1,000 feet altitude per minute, until he has reached a height of 6,000 feet. He is kept in this rarification (which represents altitude), for a certain length of time as is shown in the various tables exhibited. A fall is simulated by allowing air to enter the cabinet and the time it takes to bring the pressure to that of the earth's surface, noted to represent a rapid or slow descent. In this manner, we can simulate an actual flight and when the aviator is finally returned to the pressure of the earth's surface, he is again submitted to tests for heart, motor-power, and put through the rotation motions.

I submit the following tables as showing the different series of tests.

Table 1. From the earth's surface to 6,000 feet altitude in six minutes; immediate return to the earth's surface in thirty seconds.

Table 2. From the earth's surface to 6,000 feet altitude in six minutes; continuation at this altitude for fifteen minutes, then rapid fall to the earth's surface in thirty seconds.

Table 3. From the earth's surface to 6,000 feet altitude in six minutes; fall to the earth's surface in thirty seconds, return to 6,000 feet altitude in six minutes; return to the earth's surface in thirty seconds, applicant being supplied with oxygen all the while.

Table 4. From the earth's surface to 6,000 feet altitude in six minutes; continuation at 6,000 feet for fifteen minutes; rapid fall to the earth's surface in thirty seconds; return to 6,000 feet in six minutes and fall to the earth's surface in thirty seconds, applicant being supplied with oxygen mask all the while, to prevent oxygen want.

Fig. II. Showing Chair Used for Rotation Tests.

The Apparatus.

The apparatus consists of a steel cabinet to which is attached a vacuum pump. Fig. 3. The cabinet is supplied with a mercurial altigraph, the scale of which is marked to represent the vacuum in feet of altitude for each one-half inch. Fig. 3. This altigraph will register from the earth's surface to an altitude of 25,000 feet. The cabinet is large enough to seat the applicant comfortably while being tested, and strong enough to withstand a negative pressure of 25,000 feet altitude. It is made of plate steel, being five feet high, two and a half feet wide, and an average of three feet in depth, being longer than three feet at the floor, and less than three feet at the top.

There is a window in the front of the cabinet fourteen inches square of one-half inch plate glass, through which the one being tested can be observed. Figs. 3, 4 and 5.

The door enters the rear, being two by four and a half feet in dimension, which is locked by a lever which works sliding, beveled dogs making the door close air-tight. Fig. 4.

The cabinet is provided with four pet cocks. One for connection with the altigraph, one for a negative pressure gauge and the other two for letting in air and the connection with the vacuum pump.

The scale of altitude was taken from tables furnished by the Smithsonian Institute and is marked in feet so the altitude may be read at a glance.

The pump is a Geryk, high vacuum of a double cylinder canti-lever type, the second piston pumping against the leakage in the first. It has a four inch stroke in a one and a half cylinder. Fig. 3. The pump is operated by a one-fourth H. P. variable speed motor, which is controlled by a rheostat so the air can be removed from the cabinet quickly or slowly at the pleasure of the operator.

In the beginning it seemed simple enough to get an apparatus such as this, but upon investigation, it was found a more difficult task than I had anticipated, for when actual work was begun several pumps of various types had to be tried

Fig. III. Front View of Cabinet and Vacuum Pump.

before I was able to secure one which had volume enough to accomplish the result desired in getting air out fast enough to simulate the rapid ascension done by flyers. Considerable delay was occasioned by several leaks in and about the cabinet, but this was finally corrected, and I was able to regulate the speed of producing a partial vacuum at will.

Next was the question as to whether I could keep a man in so small a space (25 cubic feet) for a determined length of time; on account of lack of oxygen in the air contained in the cabinet, and experiments were made to show that a man could remain in the cabinet longer while the air was being exhausted around him than if no air was removed, and he was allowed to rebreathe his exhalations. I found the solution to this in the fact that we were taking away from the air in the cabinet much of the poisonous gases he produced in breathing.

This point will be further considered in a later report, as I expect to test the air contained in the cabinet for carbon dioxide at successive intervals, but it now appears that carbon dioxide is by reason of its weight pumped out faster than the oxygen, which is much lighter by weight.

It was soon determined that the man being examined had no difficulty from the change in the air, as far as respiration was concerned. In trying men in the cabinet it was determined, from them, that the sensations they felt were exactly similar to the sensations they experienced in actual flying.

One intelligent flyer of months experience as an operator of a plane in actual warfare, told me the pain in his ears and his head was the same as he had in actual work in his machine, and if one would go into the cabinet he would experience the same sensations he would in actual flying. This is important to me as we want to simulate to the greatest degree just the way they are to feel when in army work.

The type of men should be noted in the experiments I have made, as they are the same men who have been picked by the Aviation Corps for our flying squadrons. The fact of their being rare specimens both in mind and body, would lead us to believe that they would show as little change in the tests

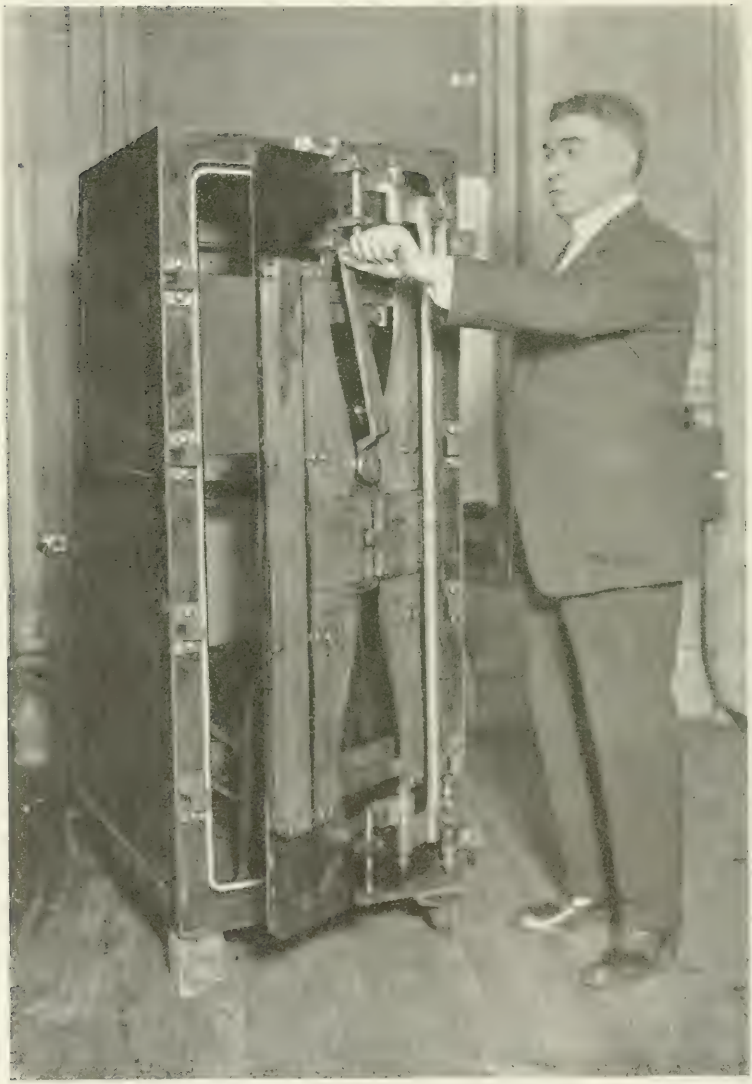

Fig. IV. Rear View Showing Door and Interior of Cabinet.

as any body of men on earth, as they are all healthy chaps from the best American stock and none of them over thirty years of age, while the great majority are from twenty to twenty-four.

Thus, the material I have used is the hardest I could possibly find in which to show defects.

Summary of Table I.

Ascent to 6000 feet in six minutes. Descent in thirty seconds. Twenty-two per cent. of cases show an increase in systolic blood pressure, while 24 per cent. show an increase of diastolic pressure of more than ten points. Thirty per cent. show an increase of systolic pressure less than ten points, while eight per cent. show an increase of less than ten points of diastolic pressure.

Summing the increase in pressure, we have, 52 per cent. showing increased systolic, and 32 per cent. diastolic pressure.

In the dynometer test, 80 per cent. show a decrease in muscle tonus equal to about 50 per cent.

In the nystagmus, *turning to the right*, only 14 per cent. showed an increased stimulation, and these were cases where the blood pressure did not change much.

In 80 per cent. of the cases there was a decided decrease in nystagmus, usually from 35 to 50 per cent. in duration.

In *turning to the left*, the results were 10 per cent. increased stimulation, all of which were less than 10 seconds more than before turning. The cases which decreased were 90 per cent. and most of them decreased about the same as right turning, being from 35 to 50 per cent. in duration, after test.

Past pointing *turning to right*. Right hand stimulation was increased in 19 per cent. more than 10 seconds and in 32 per cent. less than 10 seconds. It was decreased more than 10 seconds in 10 per cent. and less than 10 seconds in 35 per cent. of cases. In only four per cent. it remained the same as before the test.

The left hand showed about the same findings. In the *left turning*, the right hand showed an increased stimulation in 52 per cent. and a decrease in 36 per cent., while it remained the same in 12 per cent. of cases.

Fig. V. Showing Altigraph with Scale.

The left hand showed increased stimulation in 60 per cent. of cases and decreased in 28 per cent., while it remained the same in 12 per cent. of the cases examined, 14 per cent. were left-handed, who seemed to be stimulated more, turning to the *right* than to the *left*. This should be taken into consideration, in testing rotation, as the strongly right-handed will fail to respond to right turning, and the left-handed fail to the left turning.

Summary of Table II.

Ascent to 6,000 feet in six minutes. Continuation at 6,000 feet for fifteen minutes. Descent to earth's surface in thirty seconds.

Blood pressure. Twenty-six per cent. of cases showed increase of systolic pressure, of which 13 per cent. was 10 mm. or more, while in the remaining 13 per cent. the pressure change was less than 10 mm. The diastolic pressure increased in 40 per cent. of cases, of which 15 per cent. increased 10 or more mm. and 25 per cent. less than 10 mm. Six per cent. of systolic and 14 per cent. of diastolic pressure remained the same.

Dynometer. The motor impulse as measured by dynometer, increased in 32 per cent., decreased in 50 per cent. and remained the same in 18 per cent. The amount of decrease was usually about 50 per cent., while the increase was never so much.

Nystagmus, Turning to Right. There were no cases of increase equal to 10 seconds, and only 2 per cent. increased less than 10 seconds. Twelve per cent. decreased 10 seconds or more, while 84 per cent. decreased less than 10 seconds. Twelve per cent. remained the same before and after the test.

Turning to Left. There were no cases where increase was 10 or more seconds. Four per cent. increased less than 10 seconds. Twelve per cent. decreased more than 10 seconds, while 84 per cent. decreased less than 10 seconds. Ten per cent. remained the same.

This shows a pretty constant percentage in both turnings, so we can say 94 per cent. is the decrease, of which 10 or 12 per cent. show more than 10 seconds.

Past Pointing, Turning to right. Right hand. Forty-seven per cent. show increase, of which 37 per cent. were less than 10 seconds. 41 per cent. showed decrease of which 37 per cent. were less than 10 seconds. 12 per cent. remained the same.

Left Hand. Forty-nine per cent. showed increase of which 37 per cent. were less than 10 seconds, and 47 per cent. showed decrease, of which 37 per cent. were less than 10 seconds. Four per cent. showed the same after test.

Turning to Left.

Right Hand. Twenty-six per cent. showed increase, of which 24 per cent. were less than 10 seconds. Fifty-two per cent. showed decrease of which 50 per cent. were less than 10 seconds. Twenty-two per cent. showed the same.

Left Hand. Sixteen per cent. showed increase of which 8 per cent. were less than 10 seconds. Seventy-six per cent. showed decrease of which 66 per cent. were less than 10 seconds. Eight per cent. showed the same before and after.

From a study of the tables it will be observed that in those whose blood pressure was elevated showed a stimulation of the motor tone, and also a less depressed condition of the labyrinth. In those whose blood pressure was reduced the muscle tone was less (most cases to the extent of 50 per cent. or more) and the labyrinth less active.

The question as to the physiological finding may be found in one of two conditions. If air pressure is reduced from the external surface of the body, the blood pressure is at first lowered by dilatation of the capillary system, and upon return to increased pressure of air by rapid descent, the blood pressure is raised. Another is the action of the vasomotor nervous system in causing less or greater pressure by pressure in the inner ear.

These are questions for the physiologist, and I merely mention them in passing to the practical side of the question.

The matter for us to decide is whether we can tell which man will be most useful as an aviator and to classify the good from the poor.

We would say that a man whose labyrinth is stimulated by a trial flight would be more acute than one where the labyrinth became less active. A man whose muscle tone is more, or at least as great after a trial, would be better than a man whose muscle tone was impaired. A man whose blood pressure is elevated would be better than a man whose blood pressure was less.

On the one hand, we have a man who is being made more active while on the other we have a man who has a degree of shock varying as to the amount of change exhibited.

In the cases where there is not much change in the findings, we would say they would be serviceable in a balloon service, as they remain in the same medium of air for lengths of time.

Our conclusions are that where the blood pressure and muscle tone is increased, where the labyrinth is more sensitive, the man is a good risk. It is true, if this man flies long enough he may have compensation hypertrophy and arterio-sclerosis, but not for a considerable time.

The man who remains the same, that is where the changes are almost none, is a good risk for balloon service. The man with lowered blood pressure, lessened muscle tone and less stimulated labyrinth, is a bad risk, and should never be allowed above the earth's surface.

It is in this manner I have figured that in Table 1, 26 per cent. of men were unfit as aviators, and in Table 2, 33 per cent. fell below the standard test. These men, in my opinion, will probably deteriorate rapidly and fall to their death if allowed to fly.

Tests for oxygen want does not enter into the conditions exhibited in my series of observations, from the fact that oxygen want manifests itself after a considerable experience as an aviator, and it is destined to be used as a test for the life of endurance of an aviator and not as a test to show whether or not the man is fit to become a flyer.

The thought presents itself that the men who show the greatest effects of oxygen want are probably those whose defects would be shown in this test before they become actual aviators: and, therefore, I would expect the percentage of those affected by oxygen want, to be materially reduced, were men selected for air service by this test before being accepted as pilots.

I do not wish to appear too positive in my assertions, as the work is novel, and I have not had opportunity to follow these men who have been subject to my test, to find whether they remain competent to fly or not. I, therefore, submit it for its true value, reserving the right to change my opinion on any point mentioned in the scope of this paper, although it has been carefully considered, and I feel my contentions well grounded. The results of observations surely indicate that the general circulatory system has a very marked and decided effect on physiologic problems, and should teach us to consider more than vestibular findings, such as we have been accustomed to do in the diagnosis of diseased or perverted symptoms.

The tests for vestibular irritation should be taken in a more scientific manner, as some of them at present leave too much to be desired in the matter of duration and accuracy.

Nystagmus is marked in seconds, and there is no reason why past pointing and falling should not be determined in the same way. In this way, we will arrive at a more uniform method, and our findings will be of more scientific importance.

Table 1

Ascent 6000 ft. altitude in 6 minutes Descent Straight Surface in 30 seconds

Name	Age	Pulse Before	Pulse After	Blood pressure Before Sys	Blood pressure Before Dias	Blood pressure After Sys	Blood pressure After Dias	Dynamometer Before R	Dynamometer Before L	Dynamometer After R	Dynamometer After L	Rotation Before Duration	Rotation Before PP 10 to R	Rotation Before PP 10 to L	Rotation After Duration	Rotation After PP 10 to R	Rotation After PP 10 to L	Class	Remarks
												R	L	R	L	R	L	R	L	R	L	R	L		
Millish	19			138	76	145	85	2	2	3	1	33	18	20	22	14	16	20	20	24	31	15	19		
Munsell	26			140	66	145	65	4	3	3	2	10	10	5	5	5	5	14	12	24	17	14	17		
Price	19			140	80	150	70	5	3	2	2	24	24	10	5	10	5	22	31	27	9	31	24		
Kidwell	24			140	74	150	74	6	5	4	3	17	17	5	10	5	5	12	14	20	9	21	23		
Hoffman	25			120	80	130	70	6	7	6	6	25	25	20	35	27	35	27	28	15	20	15	18	B	Slightly tachycardiac after change heart open
Hargrave	25			146	87	170	82	3	5	4	5	16	15	47	40	13	17	15	18	12	14	12	17		Divergent PP Bonnet will Statistician
Griffith	29			140	90	165	90	5	4	2	2	20	20					30	30	19	11	38	40		
Stein	24			134	84	150	78	4	3	2	4	25	24	15	15	20	20	24	20	8	9	12	14		
Wilson	21	64		146	72	160	90	4	3	4	4	26	26	10	10	15	10	22	18	12	16	14	16		
Oswald	22			138	60	158	75	4	3			22	20	5	5	5	5	18	17	25	25	13	17		
Berg	19			138	80	140	85	2	2	2	1	27	25					20	22	6	10	18	8		
Burns	28			120	74	120	64	5	3	3	3	20	20	10	5	10	5	15	17	12	19	20	6		
Van Brunt	24			135	60	130	60	3	3	2	3	18	20	38	38			25	30	18	8				
Lawrence	22			140	60	130	60	4	4	3	3	5	20	5	5	10	15	21	18	12	12	30	30		Divergent P.P.
Evans	25			136	70	138	68	3	3	3	4	20	17	5	7	5	5	20	20	11	11	11	11		
Peterson	30			130	70	130	70	4	4			20	20	6	8	8	13	14	15	13	13	5	5		
Ryan	22			140	80	138	72	3	3	3	4	20	18	5	12	4	11	12	13	10	12	18	24		
Hanson	24			140	80	140	70	4	3	3	4	23	25	15	13	12	12	31	22	7	7	7	12		Left handed
Young	28	68		126	78	135	68	2	2	2	3	20	23	5	17	5	5	12	12	12	5	8	6		

Table I.

Record 2 Cows fr Alderney in 2 minutes Record 1 with cow fr 3d Jersey in 30 seconds

Name	Age	Date	Blood pressure Before		After		Respirations Before		After		Rotation Before Negative		Before Positive 10 R. 2		Before Positive 10 R. 1		Rotation After Negative		After Positive 10 R. 2		After Positive 10 R. 1		Plan	Remarks
			Systol	Diast	Systol	Diast	R	P	R	P	N	F	R	X	R	X	R	X	R	X	R	X		
Armstrong	23		112	70	110	65	2	2	1	1	22	18	10	10	10	10	15	12	5	6	10	15		
McKinnagh	28		120	52	115	70					20	20	5	5	10	5	14	13	16	16	7	8		
Hamburger	30		150	80	100	65					14	14	3	9	9	10	17	13	11	11	11	15		
Ingalls	19		120	65	13.5	75	2	2	1.5	1.5	23	18	8	8	4	8	15	13	5	5	8	10		
Jordan	35		120	75	124	78	3	3	2	2	25	25	35	22	19	21	15	20	12	7	12	22		Before Source
Stefanik	33		138	88	122	104	3	3	3	2	17	18	5	5	5	5	2(?)	10	3	3	14	18		Kept bounded R Negative seems permanent
Kenty	25		122	80	136	88	4	5	3	3	20	25	12	12	8	12	12	13	5	5	8	12		Kept bounded.
Mahamer	22		140	90	150	80	2.5	2.5	2.5	2	32	25	10	12	13	17	20	21	12	12	5	5		Shows with Kept Rise
Hansen	21		120	65	125	60	2	2	4	3	20	20	3	5	3	3	18	18	3	3	2	2		Kept bounded Miles with R. H.
Thomas	29		124	74	130	67	4	3	1	1	20	18	2	2	3	2	20	14	23	25	18	19		Summation Negative test
Bissey	22		110	70	125	80	2.5	5	1.5	2.5	25	20	1	1	2	2	21	14	21	22	17	18		Summation Negative test
Bernstein	23	8/14	126	58	130	80	5	3	1	2	24	24	35	30	10	10	20	12	8	22	12	12		
Evans	23		130	78	125	70	3.5	3.5	3	3.5	22	25	11	15	15	30	23	18	10 R 13	20 K 4	13	3		
Krieger	22		120	80	105	55	6	4	2.5	2.5	20	18	10	10	5	10	10	10	10	20 K 15	5	5		
Hodson	19	7/14 65	132	72	110	65	5	5	3.5	3	30	22	15	15	5	5	17	13	10 K 15	15	15	10 K 10		
Rodenberger	21	5	136	80	112	65					22	25	11	17	12	12	12	14	5	5	14	15		
Sheridan	20	16	130	88	118	70					22	21	8	8	10	12	18	14	10	10	25	30		Shows R H.
Towson	20	21	112	78	122	80	7	8	4.5	3	26	23	15	17	5	6	15	20	15	10	15	20		Kept bounded
Clay	27	7/14	124	78	132	80	9	10	2	3	20	18	5	15	5	5	13	7	12	16	4	5		

Ascent to 6000 ft Altitude in 6 minutes Table II. Continuation at 6000 Alt for 15 minutes. Descent to earth surface in 30 seconds.

Name	Age	Pulse	Blood pressure Before Syst	Blood pressure Before Dias	Blood pressure After Syst	Blood pressure After Dias	Nystagmus Before R	Nystagmus Before L	Nystagmus After R	Nystagmus After L	Rotation Before Nystag	Rotation Before PP10 TR	Rotation Before PP10 TL	Rotation After Nystag	Rotation After PP10 TR	Rotation After PP10 TL	Class	Remarks
Case	36	74/64	138	68	115	68	15	2	1	1	15 18	5 15	10 20	10 15	15 20	15 12		Writes with right hand throws with left
Englehart	20	76/68	148	88	130	88	2	1	1	12	15 15	30 30	20 30	8 12	25 25	12 14		
Alcock	23	RR 76	140	70	115	70	2	15	3	2	27 24	8 8	35 20	18 18	10 10	30 18		
Bowen	38	92/76	136	80	130	80	1	4	4	6	20 20	4 5	5 7	13 17	11 11	4 7		First run no effect on Nys. Was never dizzy in his life. Never sea sick
Thompson	25	72/72	140	80	130	84	4	3	3	7	15 16	5 5	7 7	12 12	3 3	3 3		Left handed mike. Use Right Hand
Goodman	34	116	138	88	130	80	25	3	2	1	22 36	5 13	10 13	16 19	35 45	6 8		Divergent PP. Turned TR
Anderson	22	84/76	130	86	115	70	6	6	2	2	20 20	5 15	10 17	9 7	5 5	5 5		
Keene	30	92/72	126	76	122	76	2	1	2	2	22 24	7 12	20 35	20 15	8 10	15 18		Auto wrecker Knows Instruments
Gallagher	28	72/70	128	84	125	75	1	1	2	2	25 25	14 17	9 10	10 16	6 12	9 17		Left handed mike,
Dudley	22	72	185	78	120	80	22	2	6	5	5 18	55 62	11 37	13 9	6 15	11 15		
Johnson	25	70/66	140	80	120	70	2	1	1	2	30 25	15 20	10 18	15 17	12 26	16 18		
Lane	25	72	124	82	130	70	2	1	2	1	30 30	11 15	10 26	17 19	15 19	16 18		
Rackhal	24	84/68	132	84	130	100	1	1	3	2	30	15	10 15	15	15 7	10 10		
McCondie	23	92/76	132	82	90	70	1	5	2	5	19 28	10 15	5 15	5 17	4 15	10 14		Vomited after test Pulse 76 in 15 minutes
Sheppard	21	64/64	146	86	120	76	3	5	2	2	24 28	5 18	20	20 23	10 25	30 15		
Fancher	22	80/70	130	70	104	76	4	3	3	2	36 36	17 20	10 12	12 14	8 6	12 12		
Reid	25	76/70	136	76	120	78	2	2	2	2	30 32	17 15	12 17	3 13	3 6	5 12		
Little	20	92/72	148	82	130	102	1	1	1	2	31 35	8 10	2 10	36 17	12 15	6 10		
Mercury	28	82/72	136	80	112	70	15	1	1	1	15 15	5 8	5 5	12 12	5 9	5 5		
Brooks	22	86/82	140	90	135	84	2	2	15	2	30 18	10 13	4 12	17 19	13 7	10 10		

Ascent to 6000 ft. Altitude in 6 minutes. Descent in 6000 ft. all in 15 minutes. Descent in 30 seconds

"Tickle"

Continuation in 6000 ft. all in 15 minutes. Descent in 30 seconds

Name	Age	Pulse	Blood pressure				Tympanometer				Dilation												Class	Remarks
			Before		After		Before		After		Before				After									
			Sept.	Diast.	Sept.	Diast.	R.	L.	R.	L.	Right		P.P. 10 m. R.		P.P. 10 m. L.		Right		P.P. 10 m. R.		P.P. 10 m. L.			
											R.	L.	R.	L.	R.	L.	R.	L.	R.	L.	R.	L.		
Wolf	23	116/70	110	70	118	72	2	1	1	1	22	20	5	7	5	20	18	17	5	7	5	15		
Hueter	22	120/80	114	64	120	80	1	1	1	1	20	22	5	12	27	17	17	16	5	14	32	10		
Calhoun	24	84/72	110	70	135	84	1	1½	1	1	12	14	10	20	12	14	12	10	7	12	8	12		
Mellin	22	72/72	125	78	145	80	5½	6	6	6½	22	25	10	15	12	16	12	21	15	20	22	45		
Crabs	25	76/80	128	75	123	76	3½	5	11	11	18	20	12	15	5	7	15	17	10	11	10	13		Injured by horse
Wolf	24	96/112	134	78	150	75	2½	4	1	2	30	25	26	30	17	21	25	24	20	17	9	18		
Barron	22	100/76	120	80	122	80	1½	2	1	1½	20	22	11	11	14	16	20	16	16	16	10	13		
Bradley	22	72/58	122	64	100	58	1½	2	3	2½	23	23	15	16	15	15	20	16	30	37	23	25		Emigrant P.P.
Hueter	26	84/72	140	68	140	60	1	1	1	2	32	33	10	12	15	16	17	24	20	32	25	22		
Hahne	24	120/84	134	70	120	65	1	1	2½	2	33	26	16	20	12	20	27	36	10	19	10	16		
Underhill	19	84/80	135	75	135	80	1½	1	1	1	22	22	20	10	20	25	16	20	22	27	18	21		
Mc Grone	26	68/60	118	70	134	80	2½	2½	3½	3	20	22	12	20	+12	+16	20	22	12	15	11	13		+ Emigrant post pointing
Golden	25	72/66	134	74	132	80	6½	3½	2½	3½	23	25	24	22	18	20	17	15	18	10	18	33		
Wright	26	60/60	130	80	130	75	8	5	5	6½	17	16	15	20	15	18	15	17	22	25	15	30		
Gross	21	60/72	120	70	118	70	1½	1	3	2	24	22	15	15	20	33	22	25	30	25	25	28		Left handed
Anderson	27	72/72	140	90	138	80	2	2	2	2	20	18	20	15	10	17	20	18	25	33	15	18		
Porter	30	96/80	138	75	134	70	1	1	2	3½	30	28	10	10	10	12	23	25	4	12	12	15		
Hertahn	21	82/84	127	70	120	80	1	1	2½	1½	20	22	16	18	12	15	18	18	15	18	17	20		
Bachman	25	84/70	130	80	125	82	2	2	2	1	21	16	30	22	22	21	15	11	25	20	15	18		
Roberts	24	64/72	130	78	118	76	1	1½	1½	1½	20	20	35	22	20	18	25	18	5	15	20	15.		

TABLE I.

Name	Age	Pulse	Blood pressure				Dynamometer				Rotation												Class	Remarks
			Before		After		Before		After		Before						After							
											Myotag.		PP10 π R		PP10 π L		Myotag.		PP10 π R		PP10 π L			
		Before Aft.	Sept	Diast	Sept	Diast	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L		
Brasse	27	104 / 104	138	86	138	70	2	2	1	1	20	23	21	14	20	30	20	20	24	18	10	28		Left handed
Mattfield	22	76 / 62	144	82	145	78	5	1	1	1	25	20	12	10	28	17	13	13	8	8	16	28		Left handed Master, note R.N
Johnson	17	82 /	118	70	135	75	2	2	3	2	20	23	6	12	8	14	15	15	5	15	6	13		
Lyons	24	74 / 72	145	88	145	85	4	3	2	1	20	20	10	14	8	10	10	11	20	13	20	17		
Mumbus	20	88 / 100	145	84	145	95	2	5	4	6	20	20	30	8	✓	13	8	11	✓	8	11	15		
Odin	30	102	136	82	120	78	8	5	3	2	18	20	8	12	5	15	12	16	15	7	✓	8		
Kommeyer	1	104	118	80	122	76	2	4	6	8	22	22	12	13	8	10	10	12	14	15	10	10		
Zippel	25	80 / 85	120	85	122	80	2	2	1	1	15	20	15	15	4	5	13	18	10	14	13	17		
Mumme	23	80 / 80	124	75	110	75	3	3	1	1	27	26	15	17	12	12	15	15	10	15	12	15		
Metz	27	80 / 70	154	76	118	60	3	3	3	2	33	34	5	15	3	17	24	20	12	22	25	31		
Wright	29	70 / 64	118	80	110	70	1	2	2	1	30	25	20	30	14	18	17	20	11	20	5	8		

Table II.

Ascent to 6000 ft. Alt. in 6 minutes Continuation on 6000 ft. pr. 15 minutes Descent in 30 seconds

Name	Age	Pulse	Blood pressure				Dynamometer				Rotation												Class	Remarks
			Before		After		Before		After		Before						After							
											Myotag.		PP10 π R		PP10 π L		Myotag.		PP10 π R		PP10 π L			
		Before Aft.	Sept	Diast	Sept	Diast	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L		
Valentine	21	76 / 80	124	76	132	72	2	1	1	1	24	30	15	18	13	15	12	17	12	1.	5	6		
Wild	28	80 / 80	132	80	130	80	1	1	1	1	20	25	20	13	17	17	20	21	12	15	17	22		
Patton	22	72 / 72	130	80	128	80	1	1	1	1	23	24	18	15	1.	1.	25	25	1.	17	1.	5		
Zerbe	21	72 / 72	118	80	110	60	1	3	2	1	20	25	10	13	4	7	17	22	13	17	4	9		

TABLE I. SUMMARY.

Blood pressure										Dynometer			Nystagmus									
Increase				Decrease				Same					10 Turns to Right					10 Turns to Left				
10 points or more		Less than 10 points		10 points or more		Less than 10 points							Increase		Decrease		Same	Increase		Decrease		Same
Sept	Nov	Sept	Nov	Sept	Nov	Sept	Nov	Sept	Nov	Inc	Dec	Same	10 Sec or more	Less than 10 sec	10 Sec or more	Less than 10 Sec		10 sec or more	Less than 10 sec	10 sec or more	Less than 10 sec	
22	24	30	8	20	32	18	24	10	12	19	80	1		14	32	48	6		10	30	70	
%	%	%	%	%	%	%	%	%	%	%	%	%		%	%	%	%		%	%	%	

Past Pointing																				Left Handed 14%	
10 Turns to Right										10 Turns to Left											
Right Hand					Left Hand					Right Hand					Left Hand					Increase	
Increase		Decrease		Same	Increase		Decrease		Same	Increase		Decrease		Same	Increase		Decrease		Same	10 Sec or more	Less than 10 sec
+10 sec	-10 sec	+10 sec	-10 sec		+10 sec	-10 sec	+10 sec	-10 sec		+10 sec	-10 sec	+10 sec	-10 sec		+10 sec	-10 sec	+10 sec	-10 sec			
19	32	10	35	4	8	34	15	33	10	26	26	10	26	12	30	30	12	16	12	20	5
%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%

TABLE II. SUMMARY.

Blood pressure										Dynometer			Nystagmus								
Increase				Decrease				Same		Inc	Dec.	Same	10 Turns to Right					10 Turns to Left				
+10 points		−10 points		+10 points		−10 points							Increase		Decrease		Same	Increase		Decrease		Same
Syst	Dias	Syst	Dias	Syst	Dias	Syst	Dias	Syst	Dias				+10 sec	−10 sec	+10 sec	−10 sec		+10 sec	−10 sec	+10 sec	−10 sec	
13 %	15 %	13 %	25 %	43 %	15 %	25 %	30 %	6 %	15 %	32 %	50 %	18 %		2 %	12 %	84 %	12 %		4 %	12 %	84 %	10 %

Past Pointing																				Left Handed 10%	
10 Turns to Right										10 Turns to Left											
Right Hand					Left Hand					Right Hand				Left Hand						R	L
Increase		Decrease		Same	Increase		Decrease		Same	Increase		Decrease		Same	Increase		Decrease		Same	Inc	Dec
+10 sec	−10 sec	+10 sec	−10 sec		+10 sec	−10 sec	+10 sec	−10 sec		+10 sec	−10 sec	+10 sec	−10 sec		+10 sec	−10 sec	+10 sec	−10 sec			
10 %	37 %	4 %	37 %	12 %	12 %	37 %	10 %	37 %	4 %	2 %	24 %	2 %	50 %	22 %	8 %	8 %	10 %	66 %	8 %	20 %	33 %

Discussion.

Lieut.-Col. Eugene R. Lewis, Dubuque, Iowa, expressed surprise at Dr. Robertson's deductions concerning the lack of reliability of the vestibular tests, and at the case used to illustrate this. The man mentioned in this connection was said to have entire absence of labyrinths, and, according to Dr. Robertson, if the speaker understood correctly, would have been a very fine man for aviation training because he never became dizzy. This was distinctly at variance with all experience and observation. The perception of motion comes through the deep (kinesthetic) sense, the motion-sensing apparatus of the internal ear, the visual sense, and the tactile sense. Of the four tracts through which these senses reach the brain, the visual tract brings less information in the air than on the ground. The deep sense brings less gravity-sensing in the air than on the ground because on the ground it is exclusively concerned with sensing the pull of gravity, whereas in the air it must sense two other factors, the pull of the propeller and the pull of centrifugal force. The fourth sense, the vestibular, whether on the ground or in the air, brings information concerning motion only, regardless of the nature or cause of the motion. The function is therefore relatively more important to the man in the air than to the man on the ground. The man to be sent into the air must have a normal vestibular apparatus. The vestibular sense alone would not furnish adequate guidance in the air, or on the ground. Neither would any other one sense. The pedestrian may succeed in ground locomotion, lacking any one of the three main motion-sensing special senses; the flyer, however, should have full normal equipment in order to be safeguarded against the "peak-load" demands of a critical air emergency.

Dr. George W. Mackenzie, Philadelphia, said Major Jones a few weeks ago had asked him in a letter if he had any suggestions to make with reference to tests for aviators. In look-

ing over Form 609 he found no tests of the vestibular apparatus. He called attention to the point that the vestibular apparatus includes not only the canals, but the sacculus and the utriculus, and that these are more important organs than the semicircular canals to the one balancing an airplane.

There are at least two excellent methods of testing the functions of the two sacs:

(a) By measuring the balancing power on a goniomotor with the eye closed.

(b) By measuring the contra-rolling movement of the eyes, as noted by Kubo, Nagle, Graeffe, and later by Barany.

These methods he has tried with satisfactory results since and found they give constant findings in normal individuals with definite deviations from the normal in definite pathologic conditions.

In all work on the labyrinth careful technic is most essential. The lack of careful technic has been responsible for most of the errors in judgment in the past. A great deal more stress has been put upon the past-pointing test than it deserves. He has found it present spontaneously in normal individuals. As a localizing symptom, it is of value only when we consider every factor in the case; for instance, he found past-pointing inward of 12 inches in both arms of a patient suffering from a cyst of the right frontal lobe, which cleared up promptly after its removal. He also noted its absence after stimulation of the semicircular canals by turning and douching in normal individuals, notably in stage dancers. As an illustration of poor technic, he called attention to the error of drawing comparisons of the past-pointing after turning with that produced by douching the ear with cold water for the reason that after-douching produces a more marked reaction generally than after-turning, and with it a more pronounced past-pointing. Concerning the comparison of vertigo and nystagmus, too much stress should not be laid upon even moderate differences in the duration, for, as he has previously pointed out, it is possible by galvanism to produce perceptible degrees of nystagmus without vertigo for some minutes after

nystagmus has ceased, when what they really mean is that they feel the ill effects of the vertigo, but not actual vertigo—the sensation of objects moving.

Dr. Robertson, in closing the discussion, emphasized the fact that he was in thorough accord with the work of the examiners, and that his own work had not been undertaken with a view to finding fault with theirs, but to find the effect after return to earth. The heart, pulse, and muscle tone were all to be taken into account just as much as was the ear. A man might have an absolutely perfect labyrinthine apparatus and yet his heart might go back on him. The heart ran away after the pressure was removed from the external part of the body, and then when the body came down to earth the force of the air coming suddenly caused the man to faint. Muscle tone was similarly affected. If a man became tired in six minutes, he would become more tired in twenty minutes. It was not a new subject. Von Stein had found that guinea pigs and rabbits became paralyzed and could not drag their feet on the ground after being subjected to partial vacuum tests. He reiterated that he was not antagonising the government but working with it, and expressed appreciation of the assistance it had given him.

JOINT MEETING WITH THE AMERICAN LARYNGOLOGICAL, RHINOLOGICAL, AND OTOLOGICAL SOCIETY.

AN INFORMAL REPORT ON OTO-LARYNGOLOGY IN THE FIRST YEAR OF THE WAR.

By Lt. Col. Harris P. Mosher, M. C. N. A., Boston, Mass.

This paper deals with the following subjects:—the activities during the past year of the Section of Surgery of the Head: the Base Hospitals at the cantonments, some gossip about them, and the medical problems of the cantonments; the present and future needs of oto-laryngology as to personnel; and, finally, a few comments on the character of the medical work in the Army and why the writer believes that is a grown man's work and not, as it has been dubbed by a few of the present stay-at-homes, work to be done by boys.

The writer's duty up to the present time has been largely in recruiting medical personnel for oto-laryngology. This naturally has aroused deep feeling, and the closing paragraphs, I am conscious, are at least reminiscent of this feeling.

Activities of the Section of Surgery of the Head.

During the war the interests of ophthalmology and oto-laryngology have been cared for in two ways. First, a committee for each specialty was organized under the Council of National Defense. These committees were responsible for sending out the questionnaires and tabulating the returns, and helped with the first assignment of personnel. The second method of caring for the interests of the two specialties was the assigning of two members from the original committees of the Council of National Defense, one for ophthalmology and one for oto-laryngology, as official members of the Surgeon General's Office. A Section of Surgery of the Head was then organized, Major Blair and Major Bagley completing the section, the first representing oral and plastic surgery and the second brain surgery. Colonel Lyster became the head of the section, but Colonel Parker, who, since last October, has been the acting chief, has recently been officially placed in charge. The men assigned to the Surgeon

General's Office for the Section of Surgery of the Head naturally consult and work in harmony with the parent committees of the Council of National Defense. The Council of National Defense, however, has always been an advisory body, and from the nature of things can be nothing else. The officers in the Surgeon General's Office naturally avail themselves of its counsel, but the Section of Surgery of the Head is the only legal body, so to speak, that deals with the affairs of oto-laryngology, ophthalmology, oral and plastic surgery and brain surgery. The Section of Surgery of the Head is classed in the Surgeon General's Office as one of the sections of the Surgical Division, the other sections in this division being General Surgery, Orthopedic Surgery, Genito-Urinary Surgery and Roentgenology.

The original committee of the Council of National Defense for oto-laryngology was Dr. Charles W. Richardson, chairman, Dr. Burt R. Shurly and Dr. H. P. Mosher. Colonel T. C. Lyster, representing the Army, and Surgeon G. B. Trible, representing the Navy, were soon added. After serving on the committee a few months, Dr. Shurly resigned in order to go overseas in charge of a Base Hospital, and his place was taken by Dr. Joseph H. Bryan.

The medical officers composing the Section of Surgery of the Head, working with the committee of the Council of National Defense, further classified the names returned in response to the questionnaires; planned a special head building for the cantonments; selected instruments and advised in the selection of the personnel for the cantonment Base Hospitals in this country and for the Base Hospitals abroad. An investigation of Ear Protectors was carried on under the direction of Major Richardson. Naturally there were many other activities in which they took part, but those just mentioned are the main ones.

The latter part of October, 1917, Colonel, now Brigadier General Lyster, Major de Schweinitz, Major Mosher and Major Jones were ordered overseas for two months' temporary duty. During Major Mosher's absence Major C. W. Richardson took his place in the Office of the Surgeon General.

Before the party sailed overseas Major Richardson was given charge in the Surgeon General's Office of the re-education of the deaf, and Dr. Max H. Goldstein came into the service in order to be associated with this work. Dr. H. W. Loeb also came into the service and was assigned the position of editor of a war manual for oto-laryngology. He spent some time in Washington collecting data and then returned to St. Louis and continued his work there. The volume on which he has been working for the past months consists in the main of abstracts of the war literature with comments. This is to be followed by a condensed operative manual. In addition, there will appear a volume of abstracts of recent war literature dealing with the specialties which compose the Section of Surgery of the Head. This volume of contemporary abstracts will appear at intervals, it is hoped, for the duration of the war.

The section of Brain Surgery has conducted a neurological school in Philadelphia, New York and Chicago. The section of Oral and Plastic Surgery has had a school in St. Louis and one in Chicago. Neither the section of Ophthalmology nor the section of Oto-laryngology has undertaken schools, feeling that the making of competent specialists in these two lines was not a matter that could be satisfactorily accomplished in a short period of a few months.

The whole subject of medical instruction in the Army, however, is now being co-ordinated by a school of instruction just starting at the Officers' Training Camp at Camp Greenleaf. All branches of medicine and surgery are to be taught there, or reviewed. The specialties which represent the Section of Surgery of the Head are of course to have their representatives. Major Thomas J. Harris is to take charge of oto-laryngology. Military necessity permitting, this course should cover a period of some three months.

A hospital for the Surgery of the Head has been started at Cape May. It is planned to send appropriate cases there as they return from overseas, and it is to act as well as the hospital of last resort for head cases occurring in the hospitals

in this country. Two staffs are contemplated, in fact; one to go abroad when the call comes, and the other to continue the work when it leaves. A corps of specially trained nurses has been at Cape May for some months. A small number of cases are already under treatment there, some thirty of which have returned from overseas. The building used for the hospital is a hotel which did not pay until taken over by the government. It will hold about 500 patients and is beautifully situated. The staff is eagerly awaiting the full equipment and the full number of patients. In the meantime the attractive bathing facilities help while away the time.

Major Greenwood has just landed overseas in charge of a number of optical units, and Major Blair is also overseas, having crossed in charge of oral and plastic units which were requested by General Pershing. Lt. Col. de Schweinitz for the moment is taking Lt. Col. Black's place in the Surgeon General's Office while he is on a western inspection trip. Lt. Col. Mosher is looking after oto-laryngology, Major Bagley brain surgery, and Major Ivy is taking Major Blair's place in charge of oral and plastic surgery. The chief work of all these men is to get adequate personnel and to place it to the best advantage. In addition, publications of war literature have been issued, schools established, students assigned to them, proper teachers obtained and the courses supervised. The main work always has been and will be until the end the delicate work of choosing and caring for the personnel. If I may be permitted to say so, firmness, judgment and tact and, as far as possible, an individual knowledge of the applicants are essential for even a partial success of this undertaking. In many ways it is not an enviable position to hold.

The Section of Surgery of the Head has for purposes of administration an independent existence in the Surgeon General's Office, and a semi-independent existence in the Base Hospitals. The main services in a Base Hospital are medicine, surgery and laboratories. The Section of Surgery of the Head is classed, like General Surgery, Orthopedic and

Genito-Urinary Surgery, as a section of the surgical service. The chief of any section may be selected as chief of the surgical service. The chief of the Section of Surgery of the Head has been selected as chief of the surgical service twice—Major Ellett, chief of the Section of Ophthalmology at Camp Meade, and Major Todd of Des Moines. The chief of the Section of Surgery of the Head, the chief of General Surgery, the chief of Orthopedics and the chief of Genito-Urinary Surgery, as well as the chief of Roentgenology, alike report to the chief of the surgical service, whose duty it is to coordinate the work of the whole service.

As a matter of fact, in most cases it has worked out that the Section of Surgery of the Head has been allowed practically an independent career.

The Section of the Surgery of the Head has no position abroad corresponding to the position which it holds in the Surgeon General's Office. Its influence, however, is markedly felt there because each Base Hospital that goes overseas has an ophthalmologist, an oto-laryngologist, an oral and plastic surgeon and a brain surgeon selected for it in the Surgeon General's Office with the advice and consent of the men mentioned above. Major Blair, who, as I said, has just landed overseas, has been appointed by the Chief Surgeon, A. E. F., as consultant for oral and plastic surgery for the forces abroad. Major McKernon, of the Post Graduate Base Hospital, who has been in France now for a year, has been appointed consultant for oto-laryngology, and richly deserves it. Major Cushing has been appointed consultant in brain surgery, and Major Greenwood has been appointed consultant for ophthalmology. Base Hospital 115, which is practically a Head Hospital, has just been asked for by cable.

Observation Trip Over Seas.

Now a few words about the trip abroad of three of the members of the Section of Surgery of the Head, and Major Jones. Colonel Lyster went in the double interest of the medical care of the flier and the use of the specialists; Major Jones went in the interest of the medical care of the flier,

and Lt. Col. de Schweinitz and Lt. Col. Mosher represented ophthalmology and oto-laryngology, respectively. The party was away four months. They spent a little over two months in France, with Paris as their headquarters, and came back by the way of England, staying there a short time. Lt. Col. de Schweinitz and Lt. Col. Mosher paired off and traveled together amicably; Colonel Lyster and Major Jones, for the most part, traveled together except when Major Jones, during the latter part of the trip, went alone into Italy. While the hoped for results and those actually obtained did not always correspond, its members brought back much first-hand information which has since proved very useful, and more than one suggestion made by the members of the party have since been put into operation.

Lt. Col. de Schweinitz and Lt. Col. Mosher visited the English hospitals where there were special eye centers, or centers for oral and plastic surgery. Otology is not yet recognized as a specialty in the English army, and there were no centers to visit. In the English army, the eye service is the best organized of the specialties. Next in excellence of organization come the oral and plastic centers, of which there are two in France and one in England. Next they visited an advanced portion of a French hospital sector. In this they found that the surgery was largely specialized. For instance, at one hospital of three thousand beds, twelve miles from the line, thoracic surgery and brain surgery were done by one man, bone and joint surgery by another, and wounds of the soft parts by a third surgeon. It was learned that early and thorough surgery had almost eliminated sepsis, and that the Carrel treatment was seldom necessary. In this same sector, at a city perhaps thirty miles from the line, a special hospital for head cases was found, and a special hospital for fractures. In other words, the French were specializing their surgery as much as possible everywhere. Major Jones, as I said, was the only one of the party to go into Italy. On his return he confirmed what we learned from other observers who had been there,—that the Italians have gone even further than the

French in specializing their surgery. Everyone who goes to Italy comes back greatly impressed with the efficiency of the Italian surgery.

We reached France at a time when the American Base Hospitals were just getting on their feet. The first period of organization was over and they were getting their final buildings under way. It is no secret that lumber was then scarce in France. The initial buildings, therefore, of almost every Base Hospital were summer hotels or French schools or monasteries or abandoned barracks. Most of these the French already used as hospitals. The French, however, turned them over to the Americans, who at once began to build additions in the shape of wooden hospital huts. None of the American hospitals had been doing much surgery up to two months ago, the time we left, except one that was situated far north, and the surgery here was civil surgery. Most of the American Base Hospitals were principally occupied treating infectious diseases, of which they had a good supply, and pneumonia. The plan was just being put in operation of sending from each hospital an operating team to the Casualty Clearing Stations of English and French. A plan copied from the English. It really will save the day, because without it the hospitals at the coast will never see any surgery but remain as they were when we saw them, hospitals for treating cases of infectious disease coming off the transports and convalescent hospitals for cases sent back home from the more fortunately situated hospitals.

Naturally we became very much interested in the whole question of hospital organization and management. Besides reporting on how the specialties were cared for by the English and French, we reported on this larger subject to the Chief Surgeon, A. E. F., and later to the Surgeon General. The chief recommendations were that base hospitals should be placed as far forward as possible, and that they should have radical control. That a consultant should be appointed for each branch of medicine and surgery, and for each of the components of the Section of Surgery of the Head; that

a chief should be appointed for the Section of Surgery of the Head, and a special head hospital established at a fitting time. It was advised further that operating teams should be sent to the Casualty Clearing Stations as a routine from each base hospital, and that centers of instruction in brain surgery, oral and plastic surgery and the surgery of the eye and ear be established. The operating teams were being started and some of the teaching centers were roughly in operation when we left. It was recommended that whatever consultants were appointed should supervise a sector radically from the front to the rear, and be responsible from the front to the rear for the continuity of the treatment.

We learned, somewhat to our astonishment, that the greatest wastage of men in the various armies was caused by common and rather undignified diseases, namely, trench fever, due to the louse, and boils and scabies. We found that last winter the great majority of our men were landed overseas ill with bronchitis or influenza, or soon came down with these diseases. When we left, a formidable committee headed by Major Strong was preparing to exterminate the louse.

The Medical Problems of the Cantonments.

Much that I have to say about the cantonments is already familiar to you because they are so nearly alike and every one here must have visited at least one of them. As you know, they are small cities with a population of twenty to forty thousand. Although they were built in a few months, they have all the appointments of cities of years of growth, from churches to jails, from libraries and theatres to fire engine houses. They are cities of youth, and poverty and old age are never seen. Except for the nursing staff, women play no part in them. In the normal cycle of a man's life, death alone is present.

At these cantonments there are 16 base hospitals for the National Army and 15 for the National Guard. Besides these there are scattered over the country General Hospitals, Post Hospitals and Special Hospitals. One of the special hospitals is being fitted out as a hospital for Head Surgery. Recon-

struction hospitals and hospitals for reeducation are soon to come. The number of beds in the Cantonment Base Hospitals varies between 1000 and 2000, the beds in the General and Post Hospitals from 150 to 500. One special hospital for tuberculosis has 1000 beds and the hospital for Head Surgery has a maximum capacity of 500. Up to the present time the total number of beds planned for in this country is over 70,000. I am not at liberty to give even approximate figures, such as the ones just given, for the hospitals contemplated and actually built abroad, but the American public can rest assured that there will be an adequate number.

The death rate is of course low, because the soldier citizens of these cantonments were chosen as physically fit before they took up residence there. The sick rate also should be low, and is low, but a curious fact, well known to all experienced medical men in the army, soon became evident—namely, that the grouping of these apparently well young men was at once followed by epidemics of disease. The infectious diseases of childhood at once appeared and took a very virulent course. Pneumonia, the friend of the old, became the deadly enemy of youth. Cerebrospinal meningitis, which is relatively rare in civil life, became almost common.

An apparently well man is often a carrier of bacteria which he gives to his fellows. Men who have long lived together, however, seem to acquire an immunity to each other's bacteria; but take men who are strangers and assemble them in large numbers, as they are today assembled in the cantonments, and infectious diseases at once appear in spite of the healthy mode of life. Infections borne by food and drink—for example, typhoid fever, have been practically stamped out. Breath-borne infections, the bacteria of which live in some part of the respiratory tract, preferable the nose and throat, are yet to be conquered.

There are no vaccines for most of these diseases. The fundamental point in dealing with them, therefore, is to prevent them by avoiding overcrowding and by providing

adequate ventilation. Recurring epidemics of cerebrospinal meningitis which took place last year at the barracks of one of the most celebrated regiments in England were controlled by such measures. The sleeping huts, which previously contained thirty beds, had ten beds taken out, so that the minimum distance between each bed was two and a half feet. In addition, half of the windows of each hut were opened at the top on a slant and nailed in this position and untouched regardless of the weather.

As the men come to the camps well, the problem is to find at once the soldiers who are carriers of disease and isolate them before they can infect their mates. This was accomplished in a dramatic fashion at one cantonment recently by having twenty-four teams of medical men meet the incoming troop trains and take cultures from the nose and throat of each recruit. Those who were found to be carriers were at once isolated and treated. Work of this kind means that the bacteriologists in this war are an overworked set of men.

The problem of the carrier is the acute medical problem of the cantonments. It is becoming evident that the nose and throat are the abode of choice of the streptococcus and probably of the organisms responsible for many of the infectious diseases. The prophylaxis of infections of the respiratory organs is a most pressing problem in this country and abroad. Striking results in the control of infectious diseases have been obtained in at least one cantonment by the use of gauze masks, and in measles the use of the gauze mask has been made compulsory. The surface only of this problem has been scratched. Never before has such an opportunity been offered to solve it. If it can be solved it will be one of the great medical achievements of the war. The poisonous gas of the enemy can be seen. We take the elaborate masks which are used by the soldiers to protect themselves against it as a matter of course. The germ-laden breath of the soldier cannot be seen, but it is even more deadly than the gas. It would cause a smile if every soldier on a transport was required to wear a gauze mask

when below or between decks, or if a less novel measure was ordered, namely, that every soldier should carry a piece of gauze and be required to cough into it. Had either of these measures been a routine procedure on the transports this last winter, my feeling is that instead of the men landing in France ill with acute or chronic pharyngitis, acute or chronic tonsillitis or acute or subacute bronchitis, which was the condition of things all through last winter, the percentage of such diseases would have been markedly reduced. I feel strongly on this point, and I am certain that I am not making a mountain out of a mole hill.

In addition to the problem of the carrier at the base hospitals the following problems have come up for solution: The control and prevention of venereal disease; the treatment of infectious diseases and of diseases of the respiratory tract; and the treatment of the surgical complications of these diseases, such as tonsillitis, mastoiditis and empyema. The oto-laryngologist, the general medical men and the bacteriologists have been by far the busiest medical officers. Waves of infection have passed over some of the cantonments, and the streptococcus has had a field day.

Only supposedly well men are chosen for the army because its sole purpose is to fight. The chief purpose of the Medical Corps, therefore, is to keep the soldier well. Unfortunately it is not its sole purpose because well men get sick and fighting men must be injured. Naturally the most dramatic part of the medical officer's work in the army is caring for the wounded; the most important part, however, is keeping the fighting men well. Preventive medicine, therefore, is the medical problem of the army par excellence. Those who have the vision to engage in the solution of its problems have under their control in the army an unparalleled human laboratory and the opportunity of a century. I feel that medical men do not as yet realize this.

If practice makes perfect the oto-laryngologists in the army today should be experts in opening peritonsillar abscess, in resecting the septum, in tonsillectomy and in mastoidectomy. They can never hope, however, to catch up

with the number of tonsils that are acting as foci of infection and thermostats for streptococci. The dentists can never hope to clean up all the teeth that are foci of infecion and the surgeons, operating as they do in some of the cantonments on ten to twenty cases of hernia a day, can never see the end of their task. It is my belief that the soldiers who are to compose the standing army which is to maintain peace when it finally comes will never take their place in the ranks unless they have normal noses and throats, or have them made normal by operation.

I am much concerned at the present time about the scientific results of this war in the medical line. Naturally, of course, I am interested first and chiefly in my own specialty. My efforts, however, must be largely confined to reminding the men in the hospitals that a great opportunity lies at their hand and urge them to grasp it. In a great measure it is a matter of keeping adequate records. One hesitates to add more paper work than is already necessary in the army. The initiative in this matter lies with the commanding officers of the Base Hospitals and the chiefs of the medical divisions. By means of the army records men can be traced for years to come. What better chance on a large scale has the medical profession ever had of settling the results of certain operative procedures—for example, tonsillectomy in chronic affections of the heart or of the joints—than is before it now? Practically every medical man serving in the army wants to go abroad. I have been in France twice during this war and I can assure you that it is a great question in my mind whether there is not a fuller scientific opportunity in this country than overseas.

The Equipment at Cantonments and Base Hospitals. Personal Notes.

The equipment at the Cantonment Hospitals is nearing completion. At the beginning of the war it was found that eighty per cent. of the surgical instruments were of German make. The instrument firms of this country were at once lined up and asked for maximum output. For a time the

men who were first at the hospitals had but little to work with except the instruments which they brought with them or had sent from their offices. Now it is only a question of asking for reasonable things and knowing how to ask for them and to have a vigorous commanding officer back up your request and repeat it if necessary, in order to get all essential instruments. Naturally the whim of every operator for special instruments cannot be granted. It is still good policy, however, to carry your pet instruments. Then you operate at your ease from the start. If the instruments wear out, you can call this your contribution to the cause in place of buying more Liberty Bonds.

Some of the men did not see why they were required to be on the ground so early, why they were not left until things were further along. They were sent because their experience was needed to start things properly. In banks, clerks are not made directors. Of course, in many cases the men first on the ground were uncomfortable. In the beginning some murmured a bit; now they brag of it. I have yet to talk with one of the pioneers who would have missed these beginning days. In many cases they helped make the hospital what it is at present, even, like Day, taking part in the carpenter work. Where the men realized their job they saw to it that the head building was not pushed off the map, that it was not used for extra barracks, that it was well placed, that the original plan was even improved upon. Take Holmes, for instance: he was put in charge of all the building by the commanding officer, and the result is no surprise to those that know him. The rest of the hospital had steam for its operating room. As a matter of course Holmes soon had it for his building. He got not only steam but everything else that the army allows, and I suspect some things that were not allowed. In fact, he has one of the show places among the cantonment hospitals. Pierce is happy at Grant now that he can keep his shoes and clothes clean. Eagleton, at Dix, is still in a delirium of enthusiasm. Knowles has a fine place at Devens, and Skillern has developed a taste for administrative work and has aspirations to become a com-

manding officer. He also is much interested in his band. He has promised to embarrass me by meeting me with it when I next go there. Harris has gone to Oglethorpe to take charge of the teaching of oto-laryngology. His worries have begun and mine have ended. Berens, Greene, Emerson and Fetterolf are just coming into the service. Wherever they go, the surgeon general's office knows that things will run right. Levy got as far away as he could and is at Camp Lewis, American Lake, Washington. Wherever men of this stamp are placed there will be no more rumors of sub-standard work like Wild's incision for mastoiditis, and no suspicion of over operating.

Haskin went early to West Point and is now professor of military hygiene. Friedberg is at Doniphan, and one of the men working under him says that being in the clinic there is better than any post graduate course abroad.

During the year, since the entrance of this country into the war, Ingals has died. He took great pride in acting for the Surgeon General's Office as state advisor, looking up the standing of applicants and furnishing the Division of Oto laryngology with their rating.

His figure comes back to me now as he stood last year by the dinner table after the banquet of the American Laryngological Association. He spoke about the war and said quietly but firmly, as was his custom, how he regretted that he could not take a more active part. He did his part, however, to the limit of his strength after the habit of his life. He suffered greatly, but lack of patriotism in a friend or acquaintance hurt him more than the pain of one of the cruelist of diseases.

The Problems of the Surgeon General's Office.

Naturally there have been many worrying problems for the Surgeon General's Office to pass upon. Of these, Oto-laryngology has had its share with the other departments. The first was the problem of consultants. Three or four consultants were appointed, but the plan from the start worked poorly, and the medical officers who held such posi-

tions had to be given the choice of taking full time duty or going on the inactive list. Part time service is considered by the man who is giving full time as an unjust discrimination against him. He holds that all men have an equal right to it, and they have. Not only does it carry an unjust discrimination, but it destroys military uniformity and control. These, of course, are simply other names for discipline, and discipline is the backbone of the military machine.

The commanding officer of an army hospital naturally has pride in having a staff of medical men who can cope with all the cases that come to his hospital, however difficult. If he is not so fortunate in his personnel or if unusual cases occur, he is at liberty to call in the most available civilian physicians. This has been necessary in at least one hospital, and may be necessary again unless more of the experienced oto-laryngologists of the country enter the service. There will be, of course, some men who cannot enter the service on account of physical disability, age or some other sufficient and good reason. Let these men, if they want to be of use, make themselves known as standing ready to help as civilians, but they should be careful not to embarrass the Government by trying to be both in uniform and out of it.

Contract surgeons have not been used in oto-laryngology, although they have been employed in some of the other departments. Pressure is being continually brought to have the government use the civilian hospitals as a part of the war machinery. If I should give my own opinion in this matter, it would be that if the war is to continue three or four years more I can see how this may become necessary. At the present time, however, it brings up the old question of divided control and part time service. The Surgeon General's Office, at present, therefore, does not favor it.

The problem of the medical student has met a happier solution. Procuring a medical education is considered by Washington as preparation for the Medical Corps of the Army, and the medical student graduates by law into that corps. Those who are serving internships in hospitals have been allowed a year for such services. Naturally, however,

many of the more ambitious and the most patriotic among our young men prefer to enter the army at once and let the army experience take the place of the interneship.

As I look at it, it is axiomatic in a war of the magnitude of the present one that our hospitals are to be short handed, and that the medical schools must run on reduced personnel. Elaboration of courses must be eliminated for the time being and the schools finally come down to the three R's of medicine. Both hospitals and medical schools, however, can help themselves by doing away with the age limit and bringing back into service the men who have retired. There is at present a committee in the Surgeon General's Office which has in charge for adjustment this most important matter of maintaining the teaching in the medical schools. There is every disposition to look on both sides of the question—England's mistake is well known. The Surgeon General's Office has been fully reminded of it.

The Need for Medical Officers.

I am continually asked if there is still need for medical men in the service. Sixteen thousand are now serving, but an imperative call has gone out for five thousand more. In the general branches of the medical service physicians of large hospital experience are badly needed. From all the cantonments the cry comes, send us experienced men. Oto-laryngology is better off than general medicine and surgery. However, when the base hospitals begin to go overseas in numbers there will not be enough experienced oto-laryngologists to take their places. To make the department of oto-laryngology what it ought to be there should be on file, ready for instant use, the names of two hundred oto-laryngologists of ripe hospital experience. These men should be ready to send in their application papers on telegraphic notice. As fast as the proper openings occur they can then be fitted in. At present the available list is less than fifty. As things stand now, if your name was on such a list you might be used in six weeks or six months. However, by standing ready to apply for a commission you have put yourself at the disposal

of the government and have fulfilled your duty, at least as. I see it.

If you take the combined membership of the American Otological Society, the American Laryngological Association and the American Laryngological, Rhinological and Otological Society and omit the duplicate names and compute the percentage of the members who are in the service it is found to be about 22%. There are five Lieutenant Colonels,—Kopetsky and Imperatori in Field Ambulance, Haskin, Professor of Military Hygiene at West Point, and Richardson and Mosher in the Surgeon General's Office. There are 41 Majors, 26 Captains and 8 Lieutenants. The records also show that there are in active service 210 oto-laryngologists and 232 ophthalmologists. Unfortunately I haven't the figures for the special sections of the American Medical Association. Owing to the large size of these sections I imagine that the percentage would be somewhat less.

Retention in a Specialty.

In the beginning of the war the Surgeon General, with his large grasp of affairs, made the statement that specialists would be used in their specialty as far as the exigencies of the military service permitted. No absolute promise could be made and none was made. Naturally some men have tried to kill the goose which laid the golden egg by considering this statement a promise. This attitude has been especially true of the men just entering the specialty. No military organization could stand for a minute if so constructed. Full command is essential in order to meet changed conditions and emergencies. Up to lately the great majority of the specialists who came into the service have been used in their specialty. A few that have been found incompetent have been transferred to other lines of the medical service. I am aware also that a few men have escaped retention in their specialty, and these failures, I am also aware, will be talked about and made the most of to the end of the chapter. The fact remains, however, that never in any war before have the medical officers been fitted

in according to their talents, and special training, as they have in this war; and this is all due to the recognition by the present Surgeon General of the fundamentals of modern medicine.

Within the last month the shortage of medical officers has become so acute, the needs of the Field Service, without which the army from the medical standpoint could not exist a day, have become so pressing that all the medical men within the draft age, specially trained or not, have been released to Field Service. This, of course, is essentially a young man's job and one that appeals to the right kind of a young man. This emergency has made it difficult now to retain in his specialty any man under forty. How long this shortage of men in the Field Service will last depends in a great measure on how the medical men of the country respond to the recent appeal. It was this scarcity of medical men which made the last call of the council of Defense necessary. War has always been an affair of young men, inconceivably sad, of course, but in a just cause, most glorious. This war, from a medical standpoint, has been an affair of older men.

It goes without saying that all physicians are not equally well trained; that all have not had the same hospital advantages. As all the physicians did not enter the service at the start and at the same time, it follows that those who came in first will outrank, for a time at least, those who came in last. You cannot make it fair any other way. The men who gave up a year ago—and what they gave up in many cases was all that they had—are not to be lightly pushed aside by those who took a year to arrange, bargain and decide. There is no game in civil life the rules of which would permit such a thing. Why should it be asked for in entering the Medical Corps of the Army?

There are not enough men of operating experience to make the medical service in oto-laryngology what it should be. Some of the best men I know—best in one sense—are not in the service. These men are beginning to come in. In the year that has elapsed they have been able to keep their homes open and to be with their families; yet in spite of having de-

layed, and in spite of having enjoyed these advantages, some of them ask on entering the service that they supplant the men already in the field. Not even a German would call this fair.

I am often asked where are the young medical men; what is the matter with them that there are not enough to do the common-place work that makes up so large a part of the army medical officer's day? If they were all the sons of physicians I should say that they took after some of their fathers.

The Character of the Medical Work.

The opinion is often expressed that the highly trained physician is wasting his time in the army; that he would be doing more good staying at home attending to the civilian population. At times this view expresses an honest conviction; occasionally, alas, it is used to drug an awakening sense of duty. As I see it, there is an abundance of worthy opportunity for the man able to grasp it.

It is true, of course, that common-place work predominates; that there is plenty of boy's work, as some have called it; that for the moment, at certain places, there is plenty of no work at all—to use an Hibernianism—plenty of just staying on the job waiting and prepared, which, by the way, is a new thing for us. It is true, to repeat, that there are plenty of all these non-picturesque and non-stimulating things; yet those who are making up their decision to serve or not, if they let the question rest here, miss the most vital point of all. In the last analysis, no one enters the service to do special medical work, to increase his scientific reputation or to gain one. The basic idea is to help win this war in the shortest possible time or, as the boys just say, "to lick the Germans"; and nothing which contributes to this end, however tedious and common-place it may be, is beneath my dignity, or saving your grace, beneath yours. It must be admitted that it is hard at times to hold true to this glorified view of the work, especially when you see the inequality of sacrifice made by men even in the service and when you learn that some of them are smugly adding to their substance even in war time and you know that yours is lessening,—but hold true to it you must. It is your

guiding star in this lonely job of measuring up to your duty in your allotted place. If you think differently and stay out of the service when you should serve, you must be prepared some day to tell your daughter—you will not need to tell her mother, for she will have it buried in her heart—that her girl chum's father, not you, kept the faith. It has made me heart-sick and weary beyond words to sit at my desk in the Surgeon General's Office and read and hear this and other threadbare excuses. As I look at it after a year of trying to do my bit with the rest, those who make this excuse have lost their American heritage of red blood.

CONDITIONS DEVELOPING IN CHRONIC SUPPURATIVE OTITIS MEDIA WHICH SHOULD CONSTITUTE THE BASIS FOR EXEMPTION FROM MILITARY SERVICE.

By EDWARD B. DENCH, Major, M. R. C., New York City.

Chronic suppurative otitis media is, as we know, an exceedingly dangerous condition. Some years ago I collated from the reports of the New York Eye and Ear Infirmary 19,000 cases of middle ear suppuration, both acute and chronic. Out of these 19,000 cases, one in every 88 suffered from some intracranial lesion, either epidural abscess, sinus thrombosis, brain abscess, or meningitis. These figures, I think, demonstrate sufficiently the seriousness, of the condition under consideration.* It is also a well known fact that for many years insurance companies have rejected for insurance all applicants with chronic middle ear suppuration, or, if they accepted them, have taken them only at a very high rate, showing that the statistics of the actuary's department had fully recognized the gravity of this condition.

From a practical point of view it is best to study all cases of suppurative otitis media from the symptomatic point of view, and from the information that can be obtained upon physical examination. We may classify the symptoms as those where there is a constant profuse discharge, a constant slight discharge, an intermittent discharge, and in the fourth place those cases where in spite of the condition, the patient states there is no discharge from the ear. From a military point of view those cases suffering from a constant profuse discharge should naturally be rejected for general military service. The fact that the patient has a profusely discharging ear not only constitutes a menace to intracranial compli-

*Medical News, October 17, 1903.

cation, but also renders the subject disagreeable to those with whom he will be thrown in contact. The necessity, moreover, of giving attention to the condition by irrigation of the ear, or cleansing the ear several times a day by other methods, would naturally detract from his usefulness as a soldier, and render him unfit for general military service. This would not apply, however, to his usefulness in some special line of military service as we find that most of these patients have been able to carry out their vocations, and to earn a livelihood.

Cases where there is a slight discharge naturally would not be disagreeable to those about them, although the menace to their life from intracranial complications would be equally great. I think that we might say from the beginning that the amount of the discharge and its character gives very little real information as regards the actual danger to which the patient is subjected. Some of the worst cases which I have seen have been those in which the discharge has been very slight, and in some cases where the patient was not conscious that there was any discharge from the ear.

Aside from the discharge, certain general symptoms dependent upon the condition may be present. The most serious of these is, I think, occasional attacks of vertigo, of which some of these patients complain. The other symptom is persistent headache. In any case of purulent otitis media where these symptoms are complained of, and where these symptoms seem to be dependent upon the condition of the middle ear, general military service should be forbidden. These remarks, of course, presuppose that the condition is allowed to remain as it exists at the time of examination, and they do not regard the possible reconstruction of these cases which we will deal with later.

Exemption from military service on account of impairment of hearing due to the condition is naturally governed by the same rules which apply to cases in which no suppuration exists.

A word might be said about those cases in which we

have an intermittent discharge from the ear. In these cases we ordinarily have a history of discharge from the ear whenever the patient suffers from a cold in the head. These cases can always be accepted for limited military service, and can, I believe, in many instances without danger either to the Government or to the patient, be accepted for general military service. We frequently find in these cases where there is a history of intermittent discharge that attention to the upper air tract and to the removal of obstructive lesions here will cure the case completely.

I am in the habit of classing all cases of middle ear suppuration under six heads. First, cases of small central perforation. In these cases there is usually a history of intermittent discharge. The condition is seldom serious, and is usually easily relieved by local treatment.

Second, cases of large kidney shaped perforation, without caries of the ossicles, and with the mucous membrane of the middle ear either dry or moist. Where the mucous membrane is dry and dermatized, the condition is a residual one, and constitutes no menace to life, and the patient is perfectly fit for military duty, provided the hearing comes up to the standard prescribed by the Government.

Incidentally, it might be remarked that this standard of hearing might, I think, be modified with advantage. According to the present standard the patient must have at least 10/20 hearing for the voice in each ear for general military service. I, personally, believe that a patient with 5/20 or less in one ear, and perfectly normal hearing in the opposite ear is perfectly competent for general military service. But this is a digression.

The third form of perforation with which we have to deal is the large kidney-shaped perforation with the presence of granulation tissue. In these cases we always have profuse discharge. The presence of granulation tissue may mean one of two things, either carious bone in the tympanic cavity, or lack of cleanliness. Cases of this kind should, in my mind, be accepted for observation. The patient should

be put in the hospital, and the granulation tissue removed, and the ear kept clean by irrigation. If at the end of a couple of weeks these ears become dry, the case becomes then a case of large kidney-shaped perforation, with a dry ear, or with an ear from which there is only a slight discharge. Depending, then, upon the degree of hearing, this case can be accepted for general military service, or limited military service.

The fourth class of cases is those in which we have a perforation in the upper posterior portion of the membrana tympani, with a sinus leading into the tympanic vault. The remainder of the drum membrane may be somewhat thickened, but frequently remains perfectly normal. The lower margin of the perforated drum membrane has become adherent to the internal tympanic wall, while the epithelium of the drum membrane has spread over the internal tympanic wall. In these cases we usually have a history of only very slight discharge, or frequently of no discharge at all. On examining the case we frequently find a dark brown crust covering the perforation, and extending out for a considerable distance on the posterior wall of the canal. These cases, I think, are the most dangerous with which we have to deal. The spreading inward of the epithelium constitutes a cholesteatomatous condition in the tympanic vault. These cases are, incidentally, prone to develop intracranial symptoms, and should not be accepted for general military service unless reconstruction is made, that is, unless the case is subjected to the radical operation. This subject will be dealt with later.

The fifth variety of perforation is complete destruction of the drum membrane, with sinuses leading in front and behind the short process of the malleus into the tympanic vault. If these cases are dry, they should be accepted for general military service, provided the hearing is adequate to pass the test. With even a slight discharge here, however, these cases should be rejected for general military service unless reconstruction is permitted. In these cases the internal tympanic wall is almost always dermatized, and,

if the ear is dry, they represent cases of spontaneous cure. The dermatization of the internal wall of the middle ear, however, renders the development of cholesteatoma of the vault exceedingly common, and, if this condition is present, as evidenced by slight discharge, they should not be accepted for general military service without reconstruction. For limited military service at home, I think that some of these cases may be accepted, but then only after reconstruction.

The sixth variety which presents itself is a case in which we have a small perforation through the membrana flacida without the presence of granulation tissue. This condition is always indicative of intratympanic caries, and such a registrant should not be accepted for military service without reconstruction. This applies to all cases whether the discharge is constant, intermittent, profuse, or scanty. In other words, this condition is an exceedingly dangerous one, and one exceedingly liable to be followed by intracranial complications.

Considering the character of the discharge, I do not place much importance on this. The discharge may be seromucous, mucopurulent, or purulent. Naturally, if the discharge is purulent and profuse, we look upon the condition as serious, but we may not regard the seromucous, or the mucopurulent discharge as devoid of danger. The character of the discharge, then, aids us but little in arriving at an opinion as to whether the patient should be accepted for military service or not, and the real opinion should be formed on speculum examination.

I have stated in describing the various varieties of perforation the relative danger of intracranial involvement in each. Certain types, as I have already remarked, are not very prone to intracranial involvement, while other types are exceedingly prone to such complication. No type, however, is free from this danger. I can recall at least one instance in which a patient presented with a large kidney-shaped perforation showed but slight discharge, and apparently no possibility of any interference with drainage. I advised

against interference in this case, yet the patient died a few months later from meningitis. While certain types of suppurative otitis media, therefore, are very apt to be followed by intracranial complications, no type is absolutely free from this possibility, and this must always be borne in mind.

The presence of labyrinthine symptoms in any case of suppurative otitis should, I think, constitute a basis for exemption. This would apply to all cases excepting those in which there was total deafness, a dead labyrinth, a dry ear, and in which the rotation test showed that compensation had completely taken place. A total deafness on one side would, according to the present rule, exempt the patient from serving except in limited military service, and for this service he would certainly be competent. The reconstruction of cases with active labyrinthine symptoms will be dealt with later.

The impairment of hearing as the result of otitis media has already been spoken of, and should be governed by the same rules which apply to non-suppurative cases. In other words, the impairment of hearing due to suppuration is no more a cause for exemption than a similar degree of impairment of hearing due to a non-suppurative lesion. As before stated, I believe that the rules governing the acceptance of subjects to the draft based upon their hearing need revision.

We now come to the question of reconstruction in these cases. Personally, I cannot too strongly urge the reconstruction of all cases of suppurative otitis media by radical operation occurring in patients who are otherwise fit for military service. I have already spoken of the removal of granulation tissue, and an attempt at obtaining a dry ear after its removal. I have also mentioned the reconstruction of those cases where the suppuration seems to be caused by nasal obstruction. These cases, however, constitute but a comparatively small number of those which have so far been rejected for military service. I believe that every case of unilateral suppurative otitis media coming before us, and where the discharge form the ear is alone

the cause of the rejection, should be subjected to the radical operation. Accumulated statistics on the result of radical operation at competent hands have shown that this operation is as free from danger as any operation in surgery. If the most approved methods of technique are employed, that is, if the primary graft is used in every case where possible, the period of convalescence in the hospital will seldom be over three weeks, and often not over two. These cases, then, go out, perfectly fit for general military service. It may be stated with truth that in a certain small proportion of these cases there will be a slight mucous discharge from the ear from the region of the tube. This only occurs in a very small proportion of cases subjected to the radical operation. It must be remembered that this discharge coming from the region of the tube constitutes no menace to the patient's life, and that it is not profuse enough to make him an object of disgust to those with whom he is brought in contact. It requires no more attention at the hands of the patient than does the washing of his face and hands. Moreover, the effect upon the hearing in some of these cases is marvelous. I have seen cases without number subjected to the radical operation where the hearing has been greatly improved as the result of this procedure. I have seen many cases where it remained the same as before operation, and I have seen a few cases where the hearing has been made worse. This last fact is of particular significance in that it gives the Government the right to exact the reconstruction of these patients for military service in that it subjects them to practically no risk either to life or to function.

I should make the same recommendation in regard to those cases where certain labyinthine symptoms exist. These patients demand operative interference because their condition is one which constitutes a menace to life. These operations are ordinarily successful, and, if successful, the patient at once becomes a valuable military asset.

In cases of double suppurative otitis media this question of reconstruction naturally becomes more grave. Here I

believe that an operation should be performed first upon the poorer ear, and, if this is successful, the other ear should be operated upon. In this way these applicants would at least be available for limited military service. The great argument in favor of reconstruction is this: It removes permanently the danger of intracranial complications, and puts the patient in a better condition than he was before. He is then able to fulfill his obligations to his country usually in a general military capacity, but always in the capacity of limited service.

Another point which may be well dwelt upon here is the question of where this reconstruction work should take place. I do not believe that as a rule the ordinary Base Hospital offers the ideal surroundings for these reconstruction cases. These operations demand exact technique and considerable experience upon the part of the surgeon. I believe that the Government could well make use of a large number of our public institutions scattered throughout the country where this work has been generally successful for many years, and where the technique has been perfected. The men could be sent to these hospitals for reconstruction, and afterwards returned to their respective military divisions. There are certainly an adequate number of medical men trained in this work, who are too old or whose health does not permit them to do more active work for the Government, who would be only too glad to do this work, and they would in this way, I believe, be serving their country better than by doing minor, though more active, work in the regular military hospitals.

Discussion.

Dr. Talbot R. Chambers, Jersey City, N. J., corroborated Dr. Dench's remarks. He recalled a meeting, a few months ago, at the New York Academy of Medicine, when a number of men reported having done radical operation, some with primary graft. All agreed that the hearing was as good or better than before operation in the majority of cases. A

man with hearing of 20/20 in one ear and 5/20 in the other might be fit for the front line, but according to the regulations he would have to be rejected. It was just the same as with 20/20 vision in one eye and the vision of the other impaired. Such a man could go into service, but the regulations would not permit it. He thought many men had been thrown out on the first draft who would go in on the second.

Dr. Joseph C. Beck, Chicago, Ill., had had considerable experience with one of the advisory boards in Chicago, and, as Dr. Chambers had said, it seemed a pity, in many instances that a man otherwise healthy was thrown out because of slight impaired hearing, many of them being not only fit but anxious to go. Many of them were willing to go into a hospital for a radical operation, but the after treatment was so tedious that it would be a long time before they could go into service. At Camp Grant a number of men had been discharged on account of tubal secretion into the middle ear after an otherwise radically operated mastoid. In six cases he had been able to make the men fit for service by subsequent closure of the orifice of the Eustachian tube. This was done by removing the mucous membrane both at the pharynx and in the middle ear, thus making a dry ear out of a discharging ear. The type of perforation had been clearly shown by Dr. Dench, and if the Advisory Boards received new orders along these lines a good many men would pass for limited service who had heretofore been rejected.

Dr. Walter B. Johnson, Paterson, N. J., said there was no commanding officer in his section, these cases being left to the general board. Ten feet with both ears was very poor hearing for a man who is to be under command in a noise. If one ear was 20 20 and the other was suppurating the man could not be admitted. He had not found many men around Paterson who wanted to get out of service, and very few malingerers, as reported by Dr. Day on the other hand,

most of them were anxious to go. It seemed too bad that a man who had lost the vision of one eye but who had good vision in the other should be refused. He should be accepted for special service. The same applied to the hearing in non-suppurating cases. As to the radical mastoid operation, many cases operated upon by this method were not dry and never do get dry, and in such cases the regulations forbid their acceptance for service. A larger number of men should be drafted so that those who are physically fit could be selected. We must prepare for the organization of an overwhelming force over there, and to win the war we must have soldiers who can stand the pressure to the end.

Dr. Henry L. Swain, New Haven, Conn., thought both sides of the question very well presented. Dr. Dench had emphasized the view that men are able to serve even though they have some moisture and some damage to the drum, while Dr. Day had shown the probability of pension claims resulting from suppuration and its sequelae. The speaker took no chances, and, as a member of an advisory board rejected all purulent cases unless dry for a long period. Once in a while it might be necessary, in the cantonments, to settle the question by operating, but this was not desirable.

Dr. S. MacCuen Smith, Philadelphia, had found many more cases of intracranial complications in the intermittent than in the continuous type. He considered it quite obviously true that the presence of a brownish-yellow, foul-smelling discharge indicated a more or less extensive bone necrosis.

Dr. Charles W. Richardson, Washington, D. C., agreed, in the main, with Dr. Day. He was a member of the board which considered the examination of registrants and the preparation of the new set of rules for examination. He had insisted on the absolute exclusion of all suppurative conditions, all chronic suppurating ears, even though dry, and even for limited military service, for the reason that conditions are different in civil and military life. The

experience of the British had been that if a man was inducted into service with suppurating ears he not only became unfit for service, but he became a source of danger to himself. It was unjust, therefore, to subject such a man to the casualties of warfare and to the dangers of disease which might cause his death as a result of exposure. But why create in the Surgeon General's Office a machinery for the correction of these defects? Why not have the defects corrected in civil life? It was all right, perhaps, for Dr. Dench and those who did a supreme radical operation to hold that these men should be reconstructed, but even Dr. Dench and others of like experience did not always get dry ears with the radical operation. Furthermore, if the man were reconstructed in the army it meant inactivity for three, four, or six months on the part of the man. And why, when physically perfect men are demanded, should the army be encumbered with men who require from four to six months to be in physical condition to be of service?

Dr. Christian R. Holmes, Cincinnati, Ohio, had given considerable thought to this subject since entering Camp Sherman last fall. He agreed with Dr. Richardson. It was a most serious proposition. When he first began to treat these cases, he asked the division surgeon to define the class that should be rejected. The reply was: "I can not tell you. The government's requirements are so difficult that it is up to you as an expert." He tried it, but the men had not been in the service more than a few weeks until, under the exposure incident to the training, they were back again. He was not convinced that only those should be accepted that were healed, or those in the first stage.

Dr. Arthur I. Weil, New Orleans, La., had had some experience in examining board work both before and after entering the service. In the examination of the first draft the instructions were to reject men with suppurating ears, and to exempt those who showed perforation of the drum membrane. Of course at that time men were exempted

more readily than now. After some experience in the cantonment he was convinced that the original plan was best, and that these men, now accepted but formerly rejected, would have trouble when they got into active service. No man with an unhealed suppuration was a proper one to be sent abroad. He did not agree that the base hospital was the proper place for the radical mastoid operation. It might be advisable, as had been suggested, to persuade these men to go to civil hospitals as candidates for limited military service.

Dr. A. P. Voislawsky, New York City, had been on the St. Luke's Hospital advisory board for a number of months, and of the men rejected for chronic suppurative otitis, not one had been induced to enter a hospital for a radical operation in spite of all the persuasive powers at his command.

Dr. Wells P. Eagleton, Newark, N. J., wished to correct an impression that seemed to pertain with reference to base hospital facilities for mastoid operations. Dr. Dench, Dr. Day, Dr. Richardson and others had expressed the opinion that these cases should be operated outside. He emphasized the fact that his experience had been that these cases heal more quickly and with better results than he had seen outside. The government put at the command of the operator men who could do bacteriological work or anything that might be required in a given case. Before he went into service he had had a very vague idea of the Carrel-Dakin method, because in hospitals it was used by internes and nurses, but with the organization made possible by the Government the use of the Carrel-Dakin solution in mastoid operations had become the routine treatment. Better results could be obtained with this operation in a military hospital than in a civil hospital.

TESTS FOR MALINGERING IN DEFECTIVE HEARING.

By PHILIP D. KERRISON, M. D., New York, N. Y.

As this subject is of present interest chiefly in connection with the examination of drafted men, it will be convenient to adopt the term used in the Government manual of directions to medical examiners and speak of the man to be examined as "the registrant."

It may be assumed that most of the tests for malingerers of deafness are known to the members of this Society. My paper may therefore be limited to a discussion of their application rather than to a description of the tests.

Before taking up this discussion, which shall be brief, two points of some practical importance should be mentioned:

(1) In examining these cases in New York City, there has been some evidence that a certain number of malingerers have been previously coached as to the tests to be employed and the reactions which should be assumed. This, I believe, has been due in part to a practice, now abandoned by the advisory board of which I am a member, of examining several registrants simultaneously in the same room. The men so examined may easily discuss later their observations and deductions, and formulate their conclusions for the benefit of those coming up later for examination.

(2 It is quite important in dealing with suspected malingerers to give no slightest hint that they are in any way under suspicion. The more unsuspecting and credulous the examiner may appear, the more readily and conclusively will the examined respond to his tests. The most glaring evidences of deception should therefore pass without comment or apparent notice until the examination is completed.

Most malingerers of deafness who are subject to the military draft know that deafness of a certain grade in either ear will exempt them. Complete bilateral deafness is therefore for various and obvious reasons rarely, if ever, claimed.

Two types of unilateral deafness are assumed, i. e., (1) deafness advanced, but not complete; and (2) absolute deafness.

The tests upon the combined results of which I am usually able to base a definite conclusion are: (1) Weber's test; (2) the loud conversational voice test: (3) the binaural stethoscope test; (4) tests eliciting incongruous variations in response; (5) the noise apparatus, reading test (Lombard's test).

My own routine method of examination is about as follows: Only one registrant at a time is admitted to the room. I learn from him which ear is the deaf or deafer one, and whether he regards this deafness as partial or complete. If only one ear is complained of, I make a rapid test of the hearing of the better ear to determine that it is functionally sound or at least only slightly subnormal. This preliminary testing of the sound ear is essential to a proper interpretation of tests to be applied later.

Weber's Test. I now apply a vibrating tuning fork of 256 double vibrations to the vertex of his skull, and if he refers the sound to his supposedly deaf ear, I am favorably impressed as to his honesty. If he refers it to his sound ear, I become skeptical, and proceed to the next test.

Loud Voice Test. The registrant's eyes are now blindfolded. Requesting him to close with a finger his better ear, which has already been determined to be approximately sound functionally, I repeat words and numbers to him at first in low voice and then in progressively lower and louder tones. If, when I have reached a pitch and intensity at which he should be able to hear and interpret the words with the sound ear even though tightly occluded, he still states that he can not hear it, I know at least that he is an intentional malingerer. This is a useful test which will expose many malingerers. An alert individual, however, may throw this procedure out of court by stating that he hears the sound through his occluded normal ear.

Stethoscope Test. For this the ordinary clinical stethoscope with funnel shape chest piece is used. One ear piece

is completely occluded with wax. Occlusion with cotton will not exclude the sound. Standing behind the registrant, the stethoscope is adjusted with the occluded ear piece in his "deaf" ear. Words in a low whisper are spoken into the funnel-shaped chest piece, which naturally he should hear perfectly. The stethoscope is removed for the ostensible purpose of trying some other test, and then replaced, the occluded ear piece being this time placed in his sound ear. If he is able to hear now approximately as well as before, we have fairly sound evidence that his deafness is either assumed or grossly exaggerated. This is a fairly reliable test.

Tests for Eliciting Contradictory Responses. The registrant's eyes are now uncovered, the sound or better ear is closed with a finger, and the "deaf" ear is subjected rapidly to the commoner classical tests, e. g., hearing distances for watch, acoumeter, whisper or conversational voice; tuning fork tests to determine lower tone range, etc. His responses, so far as he admits hearing in any of these tests, are carefully noted. Following this, he is again blind-folded and the same tests are repeated many times, fairly rapidly and in varying order. If he is a malingerer and has not in the first instance claimed almost total deafness, his responses will almost surely demonstrate incongruous and contradictory variations.

Lombard's Test. This test, which requires a Barany noise apparatus, is one of the most dependable means of determining absolute or very advanced deafness confined to one ear. It depends upon the fact that to the normal man the sound of his own voice is necessary to the proper regulation of its tone and intensity. It is carried out as follows: the noise apparatus is adjusted in his sound ear and its machinery started in order to accustom him to its grating noise. He is given a book and told to read aloud in his natural voice and not to stop reading when the noise instrument is set in action. As soon as the noise begins, a man whose opposite, or open, ear is profoundly deaf will at once raise his voice; and if his deafness is absolute, he may literally shout. The malin-

gerer, on the other hand, claiming a one-sided deafness which is not real, will continue to read in an even tone or in a tone only slightly elevated.

This is a test which a malingerer who has been coached may easily turn to his advantage. Otherwise it is one of the most useful at our disposal.

With a quiet room and sufficient time at his disposal, there are few malingerers who will be able to deceive a careful and experienced examiner. If the registrant claims absolute unilateral deafness and his reactions to the commoner tests seem to justify this claim, he should raise his voice almost to a shout when a noise apparatus is operated in his sound ear. If he claims only partial but advanced deafness, his reactions to the various tests should be approximately constant. We are able then, usually to detect the malingerer; but if the malingerer really suffer from some degree of impairment, it may be and usually is, quite impossible to determine even approximately his grade of deafness. And so it may happen that a man partially deaf, and to a degree which would exempt him from active military service, by attempting to deceive to the extent of pretending to a more advanced grade of deafness than is actually his, is stamped as a malingerer and sent to the trenches.

Bilateral Deafness. Naturally, as there are many cases representing all grades of bilateral deafness malingering may take the form merely of an exaggeration of an existing defect. If such a person were persistently to assume absolute or very profound bilateral deafness, it is difficult to say what tests would expose the deception. The time-honored tricks of attempting to ensnare him by a sudden and startling question, the use of insulting or disparaging remarks, etc., are mentioned in many text-books. Such crude methods are usually uncalled for, however, for the reason that the risks to the malingerer of such flagrant lying are too great. The pretense of partial though disabling deafness, on the other hand, though less likely to be exposed through the testimony of acquaintances, is not so difficult to detect for the reason that the malingerer is burdened with the necessity of main-

taining uniformity in his responses to the various tests. The surest means of exposure in such cases is the application of the classical tests first to one ear and then to the other, and then, after blindfolding him, repeating the same tests and comparing the two sets of responses. In my opinion the most useful single test is the exact determination by tuning forks of what he claims to be the lower tone limit of each ear. For this purpose, the Hartmann set is wholly inadequate and useless. The average man may easily remember the difference between tones an octave apart, but few men other than trained musicians could be expected to remember the exact tone of a fork previously heard. In my private work I have for many years used a set of 29 forks which without clamps represent every full note of the musical scale from 32 to 512 double vibrations. A recent actual experience will illustrate the value of tuning forks in exposing a malingerer. On April 30th last, a young man of 26 years came to my office complaining of greatly impaired hearing. My routine functional tests showed among other things that his lower tone limit in the right ear was 240 double vibrations (h). On completing my examination, I found that he was interested not so much in the question of prognosis or treatment as in what he called his "chances of getting into the army." This seemed a reasonable object of inquiry on his part. Without any suspicion of him in my mind, I concluded to run over my tests, when I found to my surprise that his lower tone limit was now 170 double vibrations. I now learned that he was subject to the draft. There is little doubt that he was contemplating this form of malingering, and was utilizing my office as a convenient source of information and me as a convenient instrument to practice upon. The point I wish to make, however, is that in this case the tuning forks exposed an intentional malingerer in a man whom I did not in the least suspect.

Discussion.

Dr. William B. Chamberlin, Cleveland, Ohio, had successfully employed the two-fork test, using two forks of the same

pitch, holding one before the ear and making one with a louder tone vibrate before the other ear, when the louder vibration would obscure the other. The ordinary cotton plug was fairly useful. When the vibrating tuning fork was placed on the vertex of the skull (Weber test) the individual had a preconceived notion, and although he would not try to deceive he would involuntarily say that he could not hear the vibrating tuning fork in the bad ear and that he could hear it in the good ear.

Dr. Kerrison, in closing the discussion, was interested to hear the different experiences with reference to the frequency of malingering in the different localities. In New York there were a great many malingerers. The tests he had reported were the ones used there. It has not been found necessary to resort to abusive measures or threats. Apropos of Dr. Day's experiences, he recalled a case related by Dr. Lewis Coffin of New York, in which a man claimed extreme bilateral deafness. After most extensive tests the examiner was still in doubt as to the truth of the registrant's statements. He was sent out, and an orderly, trained for the purpose, went out with him, offered him a cigarette, and said to him, "How did you come out?" "Oh I put it all over him!" replied the registrant.

EAR PROTECTORS.

By LIEUTENANT COLONEL CHARLES W. RICHARDSON, M. C., N. A., Washington, D. C.

The subject of a proper ear protector, to prevent injury to the conductive and receptive apparatus of the auditory mechanism, that will be serviceable under all forms of gunfire has been the quest of military surgeons for several years. At the inception of the present war, July 30, 1914, experimentors in none of the belligerent countries had perfected an efficient ear protector.

Several devices had been placed upon the market, and had the approval to a greater or lesser extent among the lay members of the military departments of the various nations, but none of those had received the indorsement of the Medical Military Department.

In the Navy, where the conditions were more acute, on account of turret firing of great guns, the medical officers and the gun crew had practically given up the use of patented devices and depended almost alone on the efficiency of dry or moist absorbent cotton.

Since the great increase in number of those permanently disabled as result of the handicap of loss of hearing, otologists in the service in all countries have sought more diligently, have experimented more actively, to find a device that will be safe, efficient and not impair the hearing too greatly, in preventing injury to the conductive and receptive apparatus, and that may be worn with comfort.

Soon after its formation the Otolaryngological Section of the Division of Surgery of the Head took up the consideration of this subject. The Research Committee of the Council of National Defense has also been doing some experimental work along the same line.

When I came into the Surgeon General's office, October 27, 1918, this subject was brought immediately to my attention

by the expression of a wish that some expedition be made in accomplishing results.

Obtaining from the Research Committee the material which they had in hand, as well as the co-operation of Surgeon G. E. Trible of the Navy and Dr. Stacey Guild of the University of Michigan, we proceeded with a series of experiments, the results of which seem to give us fair ground to believe we had found at last a fairly serviceable protector that filled as nearly as possible all the requirements.

It is interesting to note that all the devices experimented with gave the same actual results as to gradation in the test made physical, upon animals and in field work with soldiers.

The results of the test which were first received were those made upon the conducting apparatus. As is well known, these conditions are visible to ordinary vision and the deviation from the normal may be easily noted.

The results of physical experimentation were also easy to be obtained and quickly noted.

The results of the effect on the labyrinth in connection with these experiments, requires quite an elaborate technique in preparing, and considerable time is required in passing the specimens through the successive stages before they can be mounted and examined.

It would hardly benefit or elucidate the consideration of the subject by entering into the discussion of the question whether the casualties which result in marked impairment of, to complete loss of hearing is the result of the transmission of the concussion wave through the auditory conductive apparatus, or in part or entirely due to what we in otology denote as bone conduction. We are all aware of the fact that from our earliest days in the study of otology, we have absorbed and taken unto ourselves as an auditory truism that in all forms of violence to the auditory apparatus, excepting fracture of the skull through the temporal bones, that the expenditure of the violence on the conducting apparatus spared the labyrinth.

Nevertheless after reading the reports of the various experiments and findings of Witt Maack, Von Eiken, Hoessli

and others, we are fairly convinced that laboratory findings cannot completely fit in with certain clinical evidences as found in connection with cases subjected to sudden and intense changes in atmospheric pressure. Indeed, it is practically impossible to reproduce the physical atmospheric concussion typified by the bursting of a high explosive shell, in experimental work.

We may so nearly approach the actual atmospheric changes produced by the bursting of a high explosive shell in our experimentation as to be able to draw deductions therefrom as to what in all probability must take place in the actual, but I am very much disinclined to accept them as an accepted result, which seems to be the case with Seibenmann and others.

It seems to me that we will be able to reach results earlier and with more exactitude if we are willing to adopt the belief that air and bone conduction are both active in bringing about the changes in the labyrinth in these disturbances.

Those cases characterized as "shell shock" are the ones in which the element of bone conduction seems to play the most important role. Here we have a most intense, sudden and violent vibration of the atmosphere produced by the detonation of a single highly explosive shell. We have not only the concussion impression made upon the auditory apparatus, but also upon other organs within the body and not in relation with the external atmosphere.

There are a large group of cases, properly designated as concussion deafness, in which the element of airal conduction plays the all important part. Bone conduction enters only to a minor degree in the development of these cases.

These cases are those which are attended with marked impairment to complete loss of hearing. Very few of these cases show any tendency to improvement or to the restoration of their hearing.

They are most due to the prolonged exposure to highly explosive shells, shrapnel, grenades and the constant rattle of machine guns.

Then we have a fairly large group of cases with marked

impairment of hearing, quite often complete deafness, in which airal conduction is the predominating if not the only factor.

These types are exemplified by the deafness which is common among gunners in the Navy, artillerymen in the Army, and in other arms of the service where the men have been under small arm fire from the enemy and close to their own artillery fire.

The pathology of these cases is one of uncertainty as present in human beings, as there has not up to recent publication been sufficient reports of autopsy findings to warrant us coming to any exact conclusion.

We have a fair amount of material from experimental work, and if we may draw conclusions through analogous conditions, nearly approached through physical experimentation, we should have some valuable deductions.

Yoshis's reports of labyrinth sections made after single detonations, in which animals were killed on successive days up to the thirtieth day, show marked changes in the labyrinthian canal. These changes were most markedly manifested in animals killed on the third day after exposure.

In these cases there were marked changes in the cochlea contents. The inner and outer hair cells became greatly swollen. They had lost their characteristic form and structure, and in part were loosened from their support. The nuclei were displaced upward and in many instances broken into small fragments. Deiters's cells lose their structure and become changed into a homogenous mass. The pillars remain, but are bent and are stated to be indistinct. The narrow tunnel space is filled with a homogenous material. The outer tunnel and Nuel's space exist no more. The cells of Hensen are deformed, flattened out. These changes are most manifest in the first whorl and in the space characterized by the transition from the first to the second whorl of the cochlea. In successive periods of lengthened intervals in the killing of the animals, we find regeneration gradually taking place, until after a month's time, the regeneration is nearly complete.

The report of the result of autopsy findings in the labyrinth examination in soldiers dead of shell shock, although few yet in number, in a degree confirm the findings in animal experimentation.

J. S. Fraser, Hysterical Deafness in Soldiers, Lancet 1917. II, 872, and in British Journal of Laryngology, Rhinology and Otology (November and December, 1917,) shows that out of four cases of explosion injury of the ear microscopically examined, (1) Rupture of the delicate neuro-epithelial sacs and tubes of the membranous labyrinth was not found in any case; (2) Hemorrhage into the cochlear nerve at the fundus of the internal meatus was present in three out of four cases; such change is quite capable of producing deafness; (3) An early stage of degenerative neuritis was probably present in one case.

In a careful survey of the literature upon shell-shock deafness, I have been impressed with what seems to me a too great leaning to the acceptation that these cases were hysterical in character, without organic changes in the labyrinth. I am willing to accept that some cases of shell-shock are hysterical, without organic change, a synapse, between the cerebral center and the peripheral receptive auditory apparatus; but nevertheless there must be a large percentage which must show more or less organic change within the organ of Corti, temporary to be sure, which recover their function possibly quite suddenly, with the complete regeneration of the temporary labyrinthian changes.

As we have stated before, as these cases seem to be more in the nature of direct concussion rather than transmission through the auditory conducting apparatus, it is very doubtful whether any type of protector will be other than contributor in affording relief.

In the other types of injury to the ear, in which the auditory conducting apparatus plays such an important role, it is essential that we have some device that will arrest the force of concussion, diminish or arrest the injury and will still enable the wearer to hear the voice without any marked impairment of its intensity. Dr. Stacey Guild, who had

already started with a series of well calculated experiments for the Committee on Research, Council of National Defense, kindly devoted his work to the services of the Section of Otolaryngology, Division of Surgery of the Head, Surgeon General's Office. These experiments were made upon guinea pigs to determine—

1—The amount of injury to the conductive apparatus of the unprotected ear.

2—The amount of injury to the conductive apparatus of the protected ear by the several types of antiphons employed.

3—The amount of change produced in the labyrinth of those ears protected by the various types of defenders.

A second series of experiments were made for the purpose of testing the amount of concussion in the various types of protectors allowed to pass to the membrana tympani. All these experiments were most ingeniously made by Dr. Stacey Guild, and I do not propose to give more than his result herewith, as he should have all the honor and applause which comes with original work well done.

It is sufficient to state that the various types of protectors, under the various experiments and physical tests, demonstrated the same gradation of protection or efficiency.

The results of the labyrinth examinations have not as yet been received from Dr. Stacey Guild, but I have from him a letter in which he states that the results of his examination show the same relative protection to the labyrinth as the same protectors showed in the protection of the conductive apparatus.

The experiments resorted to by Dr. Stacey Guild of Ann Arbor, Michigan, and the results obtained are displayed in the table which I have placed upon the wall and shall now proceed to explain.

"The fifth table" contains the experimental work with the physical tests of the various antiphons in indicating how much sound concussion they permit to pass. This was indicated by markings on a tambour. The passage of sound waves was indicated in the exact ratio as the experiments

to the defenders, in chart No. 4. The position is not altered in any particular.

The report which was furnished by the Otolaryngological Section of the Division of Surgery of the Head to the Surgeon General we are able to present to you. This will furnish as the conclusions made through our various forms of investigations.

February 21, 1918.

MEMORANDUM FOR THE SURGEON GENERAL.

Subject: Ear Protectors for the benefit of the soldiers in actual conflict.

1. The subject of protection to the soldier at the front, from the various forms of injury to the auditory apparatus, or to its receptive center, is so important that it is imperative that this department should suggest to the non-medical divisions of the Army what forms of device will lessen the number of those who suffer the ill consequences of injury to the auditory apparatus.

There are various points of view from which to consider this subject.

First. There is the immediate incapacity of the affected man for service, for a shorter or longer period, some of whom must be discharged.

Second. As all men who are subject to injury of the auditory apparatus require medical attention, the time of medical officers, nurses and equipment could be available for other purposes.

Third. The more severe cases result in permanent deafness, which, besides being a great handicap, impairs the soldier's later social and industrial life.

Fourth. The subject of pension and compensation becomes an immediate financial consideration.

2. The *causes* of injuries may be divided into two different groups:

First. Those which are due to a single detonation or continued single detonations, such as artillery fire; and,

Second. Those which are due to continuous sounds such as continued concussion of the air as produced by massed artillery and trench mortars and machine guns.

3. The *character* of the injury may be divided into three different groups:

First. Rupture of the membrana tympani and other injuries of the conductive apparatus.

Second. Those caused by organic injury from slight to complete destruction of the labyrinth.

Third. A large number of cases which do not belong to either of these groups, but in which both may be factors; functional disorders, most frequently of the central nervous system.

4. It has been the object of the Section of Otolaryngology to make a thorough and careful investigation of the various forms of devices that have been invented for the purpose of lessening these various disturbances. All of these have one single object: that is, the lessening of the severity of the concussion impact, either of the single or continuous type at its receptive point, the conducting apparatus of the ear. These devices have as their primary conception that the injury produced by air concussion from detonation is transmitted through the conducting apparatus. All of them have the mechanical idea of lessening this condition by shutting off in various ways, the force of the air concussion, and yet permitting sound waves to reach the membrana tympani so that the soldier may be protected, yet hear. Necessarily, most of these appliances diminish to a certain extent the hearing power. These mechanical devices have been tested on the living animal; have been tested physically to show how much each one permits the passage of the force of air concussion to the membrana tympani, and also rather imperfectly on the human subject at such stations as Indian Head and the Navy Yard at Washington.

5. It is rather interesting and singular to note that all three types of experiments actually coincide as to the gradation of each instrument. Before going further, I want to state that a great deal of honor is due to Dr. Stacey Guild,

of Ann Arbor, Michigan, for his experimentations, physical and upon animals. He not only studied out the types of experimentation to be made, but he also conducted them so thoroughly and satisfactorily that there can be no question as to their character. It has been through his experimentation that results have been reached. Dr. Guild has other experiments, partially completed, to bring before us, which will show much as to the types of injury produced by animal experimentation upon the labyrinth. But we cannot wait longer for these experiments, as the time is now coming closely to hand when the soldier will need the assistance of these various mechanical devices. We have sufficient data, we feel, to decide the question.

It will hardly be necessary to go into the various types of experimentation, and the lines along which they are carried out, as it will take a good deal of your time, and while interesting, would not enable you to come to a quicker conclusion. I simply present to you the results:

6. There are three important features in the device:

First. Applicability.
Second. Safety.
Third. Cheapness.

All types of hard and metallic forms of protectors are dangerous, because in cases of gunshot wounds, shrapnel wounds about the auricle or canal, they are likely to become secondary foreign bodies. Therefore, we feel very much inclined to eliminate mechanical devices, such as the Wilson-Michaelson and Mallock-Armstrong. Some of the cheapest, while fairly good protectors, should be ruled out, because they cut off the conduction of air sounds too greatly.

There is no question, through all of our experimentations, but that we have found one actual protector in what is known as the British Tommy, manufactured by George F. Berry, 4 Cullum Street, Fenchurch St., London, E. C. This device is simple, easy to introduce, and causes no undue pressure, and is easy to remove. While it cuts down the hearing, it does not cut it down sufficiently to impair the voice beyond military needs. It prevents impact of con-

cussion upon the membrana tympani, the conducting apparatus; it is safe; there is no possibility of forcing it in against the membrana tympani; it is not likely to be any more conducive to secondary foreign bodies than anything that could be worn in the war; and it is comparatively cheap. In all of our tests, as you will observe by the charts and exhibits which accompany this paper, it has proved itself the best protector. Actual experimentation upon the living has been impossible with the Tommy at our station here, because we have not been able to procure these protectors. The one set which I transmit with this communication is the only pair which we have. The cost is about a shilling a pair; they can be procured in London, and furnished to our troops on the western front.

The next most satisfactory is the Mallock-Armstrong, made by the Mallock-Armstrong Defender Company, 2 Palmer St., Westminster, London, S. W.

The only objection we have to the Mallock-Armstrong is the fact that it is made out of hard rubber, and is apt to become secondary points of foreign body injuries. In other respects it is nearly as good as the Tommy. It is not as easy to introduce as the former device.

The next device which I would like to call your attention to is the Baum. It is very simple; very easily introduced into the ear; not so easily removed. It can be worn for longer or shorter period without causing any inconvenience to the patient. It is light in weight, and there are practically no dangers attending upon its wearing as regards secondary foreign bodies. It is not nearly as good as the other two mentioned. It does not present the fine degree of prevention as do the other to concussion impacts; but it is an American invention, and can be bought at a very reasonable price.

I cannot close without referring to the Wilson-Michelson device, which is planned somewhat on the type of the Mallock-Armstrong. It has a movable valve, which has been demonstrated under our experimentation not to move as freely as it should with the detonations with which we have experimented. Under more forceful concussion, such as takes

place in actual warfare, it might respond more favorably. It has the advantage of being a perfect conductor for the voice. It has the disadvantage of being made of hard rubber, and therefore possesses the danger of secondary foreign body injury. It is from experimentation, a little difficult to wear, and for longer wear it would be inconvenient.

Cotton, saturated with glycerine or vaseline is the cheapest of all; most available, easy to obtain, constantly at hand. It is practically within the reach of every soldier. Soldiers are very much inclined to use cotton in the dry state. It is only in the wet state that it is of any value to prevent shock concussion. This wetting should be done preferably with glycerine or with vaseline. Either one impairs the conduction of sonorous sound waves. Therefore, while it is the cheapest, the most easily available, one that is most likely to be used, it has the disadvantage of deafening the wearer more than any other.

7. In closing, I would suggest that some arrangements be made by which several thousand of the Tommy could be purchased, and be placed in the hands of the troops in the field.

I would also suggest that rules be made by which the soldiers to whom these apparatus are given, be commanded to wear them, the same as they are with their gas masks.

I will also suggest that if any other forms of mechanical apparatus, or of cotton saturated, is thought of being used, that it is bought in the same quantity, and on the same conditions as the Tommy, so that we can have definite, actual warfare experiments as to which mechanical device, or cotton, is of the greatest value.

Charles W. Richardson,
Major, Medical Reserve Corps.
In Charge of Section of Otolaryngology.

March 4, 1918.

ADDENDUM TO MEMORANDUM FOR THE SURGEON GENERAL:

(Ear Protectors for the benefit of the soldiers in actual conflict.)

Since the completion of the preceding report some new examinations of the labyrinthine injuries in experimental cases have been obtained, and they might slightly modify our report with regard to the other experimental findings.

As is well known, injuries to the membrana tympani often give relief to the labyrinthine contents. In other words where the force of the concussion is expended on the conducting apparatus, it relieves the impact on the internal ear or labyrinthine structures, and vice versa.

While it is possible that there may be an alteration in our report, when the full result of labyrinthine tests come in, we are not inclined to believe that they will affect the result of our original experiments.

It is well to call attention to the fact that there may be, as there has been, some objection to the wearing of rubber in the auditory canal. As this wearing is not continuous we do not think it will militate against the value of the rubber instrument that we have suggested. Of course, the simpler type of instrument which produces no pressure would be of the utmost value; but on the other hand, they do not protect.

April 14, 1918.

MEMORANDUM FOR THE SURGEON GENERAL:

The summary of Major C. W. Richardson's report on Ear Protectors is as follows:

1. Of the four protectors tested, the British Tommy is the best.

2. Soldiers are in the habit of using dry cotton as a protector. Cotton is efficient only when moistened with glycerine or vaseline. It deafens the wearer more than the Tommy.

3. It is recommended that several thousand of the Tommy protectors be purchased and issued to the troops with orders to wear them the same as their gas masks.

4. It is recommended also that cotton saturated with glycerine and vaseline be issued to a certain number of men, so that the relative merits of the Tommy and vaseline cotton can be determined, and the question settled as to which is the more practical under the conditions of actual warfare.

HARRIS P. MOSHER,
Major, Medical Reserve Corps.

TABLE I.

Control Experiments.

Animals with both ears open; no apparatus in either ear.

Guinea pig No.	Distance of nearest ear from muzzle	No. of shots fired	Side	Condition of tympanic membrane at autopsy.	Amount of coagulate in and on mucous membrane of the middle ear	Evidence indicating edema of the mucous membrane	Remarks
45	60 cm.	1	Rt.	Intact—radical streak of coagulate	Small	Slightly loosened	Shooting from above and in front of animal downward at 20° angle with area
			Left	Intact	One large the horizontal	Slightly loosened	
44	30 cm.	1	Rt.	About ⅓ of area broken	Medium	Loosened	Shooting from above and in front downward about 20° slightly along left side
			Left	Whole center gone	Small	Loosened	
16	15 cm.	1	Rt.	Off along most of circumference	Medium	.....	From above and behind directly over animal
			Left	Not quite as bad as rt. side	Medium	Loosened	
17	15 cm.	5	Rt.	Intact	None	None	(See text matter below) From above and in front alone rt. side of animal
			Left	Completely gone	Large	.....	
18	5 cm.	3	Rt.			None	(See text matter below) From above and in front along left side
			Left			.....	
39	10 cm.	2	Rt.	Off of ¾ of circumference	Medium	Loosened	Shooting from directly above
			Left	Fringes only left	Large	Loosened	

The finding of the normal middle ear parts in one side of No. 17 and No. 18, after shots fired at so short a distance is to be interpreted only on the basis of the external canal having been pinched shut by the jaw pieces of the holding apparatus. These cases were among the first animals used and thereafter special precaution was taken to prevent repetition of this condition, as has been mentioned in the description of the routine procedure. For a short time after the shooting the animals appeared to be somewhat dazed, but none were unconscious when released. The last one listed above was not placed in the holding apparatus and it was able to run away after each shot; it did not stagger, but seemed somewhat dazed.

TABLE II.

Control Experiments.

Animals with glass tube and rubber "ear" (without any preventive device inserted) in one ear and the other ear open.

Guinea pig No.	Side	Smallest diameter of the glass tube in mm.	Condition of wax packing after shooting	Condition of tympanic membrane at autopsy	Amount of coagulate in and on mucous membrane of the middle ear.	Evidence indicating edema of the mucous membrane	Remarks
19	Rt.	3.5	OK	Ruptured badly	Medium	.....	Two shots—one at 10 cm. from each ear backward along sides
	Left	...	...	Ruptured badly	Medium	.....	
52	Rt.	...	...	Off on ¾ of circumf.	Large	Slightly Loosened	Usual arrangement*
	Left	3.5	OK	Fringes	Large	Badly Loosened	
51	Rt.	...	...	Fringe	Large	Slightly loosened	
	Left	3.1	OK	Fringe	Large	Slightly loosened	Usual arrangement*
50	Rt.	...	...	Fringe	Large	Loosened	Usual arrangement*
	Left	2.5	OK	Fringe	Large	Loosened	
49	Rt.	...	...	Off on ⅓ of circumf.	Medium	Loosened	Usual arrangement*
	Left	2.0	OK	Off on ½ of circumf.	Medium	Badly loosened	
47	Rt.	...	...	Off on ⅘ of circumf.	Medium	Loosened	Usual arrangement*
	Left	2.0	End of glass partly stopped	Intact	Streak about tympanic ring	None	
42	Rt.	...	...	Fringe	Medium	None	Usual arrangement*
	Left	2.0	End of glass partly stopped	Intact	Small	None	
43	Rt.	...	...	Fringes	Medium	Slightly loosened	Usual arrangement*
	Left	1.5	OK	Intact	None	None	

*One shot at 15 cm. fired with the muzzle of the pistol in front of and slightly above the animal and pointing downward along the left side at an angle of about 20 degrees with the horizontal, just avoiding the holding apparatus with the bullet.

TABLE III.

Record of the Unprotected Ear (Control Ear) of the Animals with which the other ear was "protected."

(The right ear was open in all cases.)

(For the shooting arrangement, see footnote to Table II.)

Guinea pig No.	Condition of Tympanic membrane at autopsy.	Amount of Coagulate in and on mucous membrane of the middle ear.	Evidence indicating edema of the mucous membrane.
21	Off on ½ circumf.	Medium	
22	Off on ¾ circumf.	Small	
23	Off on ⅘ circumf.	Small	Loosened
24	Off on ⅓ circumf.	Large	
25	Off on ½ circumf.	Large	Loosened
26	Off on ½ circumf.	Medium	
27	Off on ½ circumf.	Medium	
28	Only fringes left	Medium	
29	¼ area gone	Very small	
30	½ area gone	Small	
31	Only fringes left	Large	
32	Only fringes left	Large	
33	Only fringes left	Small	
34	Only fringes left	Large	Loosened
35	Only fringes left	Small	None
36	Off on ½ circumf.	Large	Loosened
37	A radical slit	Only on edges of slit—no other	Loosened
38	Only fringes left	Large	Loosened
40	Whole center out	Large	Loosened
41	Off on ¾ circumf.	Large	None
53	Only fringes left	Medium	Slightly loosened
54	Whole center out	Medium	Slightly loosened
55	⅔ area out	Medium	Slightly loosened
56	A wide fringe left	Large	None
57	Only a fringe	Very large	Badly loosened
58	Only a fringe	Medium	Slightly loosened
59	Only a fringe	Medium	Badly loosened
60	Only a fringe	Medium	Badly loosened
61	Completely gone	Small	Slightly loosened

TABLE IV.

Record of the "Protected" Ears.

(The left ear in each case; for the shooting arrangement, see the footnote to Table II.)

Preventive device being tested	Guinea pig No.	Smallest diameter of the glass tube in mm.	Condition of wax packing after shooting	Condition of tympanic membrane at autopsy	Amount of coagulate in and on mucous membrane of the middle ear	Evidence indicating edema of the mucous membrane
Scientific Ear	26	2.5	OK	Intact	None	.....
Drum	56	3.5	OK	Intact	None	None
Protector			?	Intact	None	None
"Tommy"	32	2.5	Bit of wax in tube	Intact	One area	.....
	25	2.5				
Mallock-Armstrong	21	2.5	OK	Intact	Two areas	.....
Ear Defender	53	3.5	OK	Intact	None	None
	22	2.5	Loosened	Intact	None	.....
Wax Cone of the	33	3.5	OK	Intact	None	None
Italian	34	3.5	OK	Intact	Very small	None
navy type	57	3.5	OK	Intact	Slight	None
Cotton saturated with vaseline well worked in	60	3.5	OK	Intact	None	None
	61	3.5	OK	Intact	Along ¼ tympanic ring	Very slightly loosened
				radial streak coagulate		
	40	2.0[1]	OK	Intact	None	None
	41	2.0[1]	Slightly loosened	Intact	None	None
Cotton saturated with glycerin-air was marked out as much as possible[2]	55	3.5	OK	Intact	Streak about tympanic ring Two other areas	Slightly loosened
	59	3.5	OK	Intact	¾ of circumf. tympanic ring	None
	37	2.0[1]	OK	Intact	None	None

TABLE IV—Continued.

Preventive device being tested	Guinea pig No.	Smallest diameter of the glass tube in mm.	Condition of wax packing after shooting.	Condition of tympanic membrane at autopsy	Amount of coagulate in and on mucous membrane of the middle ear	Evidence indicating edema of the mucous membrane
Dry cotton-packed firmly	35	3.5	OK	Hole about clot on outer surface	One area	Loosened
Dry cotton packed firmly	58	3.5	OK	Radial slit	Edges of slit-medium elsewhere	Badly loosened
	36	2.0[1]	OK	Intact	Along $\frac{1}{8}$ tympanic ring one other large area	.....
Eliott Perfect Ear Protector[3]	23	2.5	OK	Off on $\frac{2}{5}$ circumf.	None	Loosened
	28	3.5	OK	Intact	Along $\frac{1}{2}$ tympanic ring	.....
	54	3.5	OK	Intact	Along all tympanic ring	Slightly loosened
Device submitted to the Council by Dr. J. G. Wilson and Prof. A. Michelson	27	2.5	OK	Intact	Along $\frac{2}{3}$ ring other small areas	.....
			OK	Intact	3 streaks along parts of rings several small areas	.....
	31	3.5	OK	Hole about 3 mm. in diameter	Several small areas one large	.....

1. Controls indicate that the 2 mm. tube is too small, so the results with it must be discounted.

2. A fourth animal was found at autopsy to have a thickened tympanic membrane due to an old infection, and so has not been included.

3. Two more animals were tried with this device; with both the wax packing was not in good condition when examined after the shooting, and accordingly the results are not included. Both showed positive injuries.

TYPES OF MASTOID STRUCTURE WITH SPECIAL REFERENCE TO THEIR DIFFERENTIATION BY MEANS OF STEREO-RADIOGRAPHY.*

By F. NOLTON BIGELOW, M. D., Providence, R. I.

The mastoid radiogram, considered at one time a fad of doubtful value, has within the past five years come to be recognized as the otologist's "best consultant[1]". The pioneer work in mastoid radiography, begun in 1907, may be said to have been completed by 1912, for judging by the literature that appeared during that period, several observers had attained results equal to those of the present day. The reason that the profession as a whole was so slow to recognize the practical value of X-ray findings was undoubtedly due to the fact that the mastoid radiogram requires a considerable degree of technical perfection, to be a practical and reliable aid in the diagnosis of mastoid infection. Iglauer[2] and Lange[3], Birkett[4] and Pirie[5] and other pioneers in this field, otologist and radiologist working together, were enabled in large measure to overcome technical difficulties, and therefore found the mastoid radiogram to be of considerable value. But so far as the majority of otologists were concerned, useful radiograms were for the most part unobtainable, and the rank and file were compelled to wait till improved technique and apparatus placed this valuable aid at their disposal. During this transition period mastoid radiography was naturally subjected to much adverse criticism, due more to faults in technique than to its inherent limitations.

At the present day a storm of protest would undoubtedly arise should the practical value of this means of investigation be seriously questioned, yet in the discussion of every day problems of middle ear and mastoid infection the

*Candidate's thesis of the American Laryngological, Rhinological and Otological Society. Recommended for publication by their Council.

possible value of the mastoid radiogram is still little emphasized. In proof of this statement the following may be cited. In December 1916, a paper was read before the American Academy of Ophthalmology and Oto-Laryngology to which the author[6] gave the detailed replies to three questions sent to leading otologists throughout the country. These questions were as follows:

"In an uncomplicated case of acute suppurative otitis media, how long would you treat it conservatively before opening the mastoid antrum? After opening the mastoid antrum, how long would you wait, provided the case showed no signs of improvement, before performing the radical operation? In an uncomplicated case of acute suppurative otitis media, provided you had not had the care of the case during the acute stage, how long would you treat the case conservatively before performing the radical operation?"

It is not unreasonable to assume that in any one of these conditions the mastoid radiogram might be the deciding factor, either for or against operation; yet in the nineteen replies to these questions, the possible significance of X-ray findings is mentioned but once, and in the discussion that followed the reading of the paper three times, in two instances by men who had not mentioned the same in their replies. Out of twenty-five otologists, who expressed opinions in one way or another, there were four who mentioned the possible value of radiography.

It is also noteworthy that as regards question one, early mastoid operation, which under the conditions stated means exploratory operation, was advocated by three men who did not mention X-ray examination. If radiography has any diagnostic value whatever, it is in determining what is going on inside a mastoid previous to operation. Therefore, instead of the slogan, "When in doubt operate," why not this variation, "When in doubt radiograph, if still in doubt, operate."

As stated before, the above discussion gives the opinions of twenty-five otologists regarding three every day problems of middle ear infection. When taken as a whole, these

opinions emphasize the significance of pathology and mention in detail the means for determining the same; yet in no instance is either the clinical or the surgical significance of mastoid structure even mentioned.

Mastoids differ one from the other as do buildings, which vary in size, thickness of walls and partitions, number, size and arrangement of rooms. Can we imagine a body of engineers attempting to solve the problems of strain and stress that occur in buildings, without taking into account variations in structure Are we as otologists any more justified in attempting to determine the behavior of mastoids under the strain and stress of infection without also taking into account variations in anatomical structure?

Papers [7, 8] on the clinical significance of mastoid structure have appeared from time to time and every man who does mastoid operations not only learns that mastoid structure varies, but often discovers at operation how some unsuspected peculiarity of structure has masked or otherwise influenced the clinical picture. Referring again to question one for a concrete illustration, "an uncomplicated case of acute suppurative otitis media", in other words, an otorrhea without other signs or symptoms the mastoid in this case might either be large with many large, pneumatic cells widely distributed or it might be small with practically no cell structure whatever. Would not definite knowledge on this point enable the observer to predict the clinical course and probable outcome of this case with greater exactness, and would not his therapeutic measures be based more on scientific principals and less on empericism?

Before the advent of mastoid radiography, there was no means by which the structure of a mastoid could be accurately determined previous to operation; consequently mastoid structure received little or no consideration as a clinical factor; for while it is true, that the size and shape of the mastoid may give some clue as to the under-lying anatomy, yet experience has proven that for the most part this is but the merest guess work. To determine previous to operation the size, distribution and approximate number

of the mastoid cells and the location of the sinus, the radiogram is the sine qua non. While this fact has been mentioned in practically every paper on mastoid radiography, yet for the most part, these investigations have been devoted more to mastoid pathology than to mastoid structure.

The classification of mastoids into three types according to cell structure, the pneumatic or air containing, the diploetic or non-air containing, and the mixed, is the one generally used. To make this classification useful for clinical study and comparison, it must be made more descriptive and sufficiently comprehensive to include such other variable factors of mastoid structure as have clinical significance, among which are the thickness and density of cortex and cell partitions, the number, distribution and arrangement of cells and the location of the sinus. Both the diploetic and the pneumatic mastoid can be divided in three distinct anatomical types, each type having both clinical and surgical significance peculiar to itself.

Cheatle [9] [10] [11] [12] [13] has made an exhaustive anatomical study of mastoid structure and his description of the diploetic types is so clear and concise, that to attempt to summarize the same would do his work an injustice. Therefore these types, with such additions and references to actual cases as seem pertinent, will be described in Mr. Cheatle's own words [11] which are as follows:

"I apply the term 'infantile' to those bones which retain throughout life the characteristics of the outer antral wall and the mastoid mass as seen in infancy (Fig. 1). On making a lateral vertical section through the antrum and the mastoid mass in infancy it will be seen that the outer wall of the antrum is composed of two layers—a thin outer layer of compact bone, and an inner layer of fine cells. These cells are formed before birth; therefore I call them the 'foetal cells' to distinguish them from any which may form in later life, and from which they can be differentiated always by their fineness and inward direction. The mastoid mass is as a rule diploetic, but it may be formed of dense bone (Fig. 2). If the mass is diploetic, a thin layer of

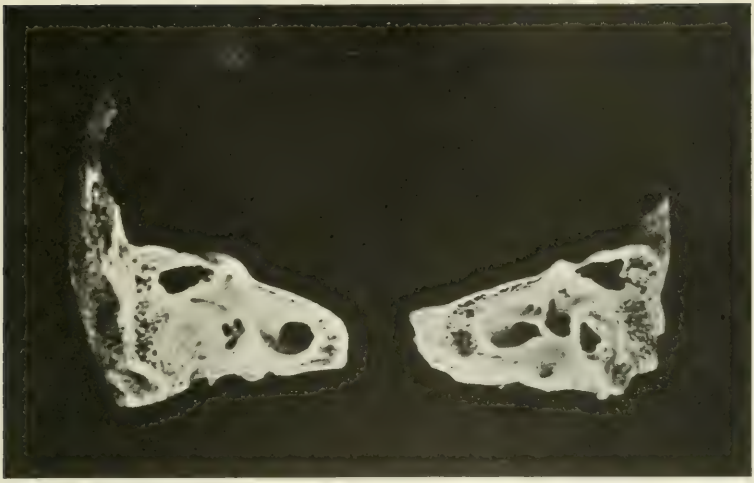

Fig. 1. Right bone of a male aged nine months, showing the diploetic type of "mastoid mass" in infancy.

Fig. 2. Right bone of a male aged seven months, showing the dense type of "mastoid mass" in infancy.

(Figures 1, 2, 3 and 4 are reproductions of Cheatle's original illustrations (9).

compact bone, which can be easily demonstrated by scraping away the diploe, separates it from the antral cavity. There are therefore two types in infancy: one in which the mastoid mass is diploetic and one in which the mastoid mass is dense. Each type may persist all through life but of course on an exaggerated scale."

Type 1. "The diploetic type in the adult. In this type the thin outer compact layer of the antral wall has increased in thickness from the periosteal side and is of extreme density; the inner layer of 'foetal cells' is still seen; the mastoid mass is entirely diploetic, and the separating layer between the diploe and the cavity of the antrum is much increased in thickness (Fig. 3). Whenever the mastoid process is entirely diploetic the outer antral wall is always formed of dense bone. This type is seen in about 20 per cent. of all bones, and it can be seen at all ages.

Type 2. "The dense form in the adult. In this type the dense mastoid mass persists all through life, but the outer antral wall remains the same as in the diploetic type, the outer layer being very much increased in thickness and of extreme density, while the inner layer of 'foetal cells' is still seen (Fig. 4). This form is only seen in about 1 or 2 per cent. of all bones." In the writer's experience, the cortical surface of mastoids of this type often has a warped appearance due to deep irregularly triangular depression or wrinkle at the upper posterior border of the mastoid. (Case 2, 3.)

Continuing Mr. Cheatle's description: "The outer antral wall is often of great thickness as well as density in these infantile types. The greatest depth of antrum from the surface is seen in them; it may measure three-quarters of an inch (19 mm.). A forward lateral sinus is usual and is found much more frequently and to a much greater extent than in the cellular types. The sinus often comes well forward below the level of the antrum and may reach the posterior meatal wall, or it may even dip in between the cavity of the antrum and the surface (Case 1, Fig. 5). The antrum may be large or small; if large, the posterior wall

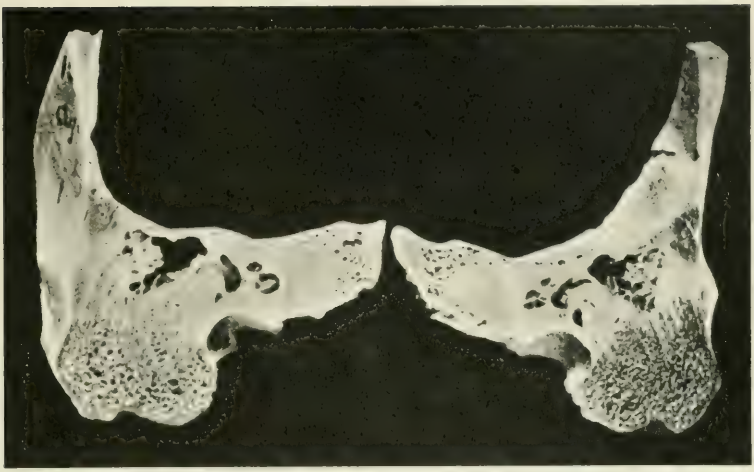

Fig. 3. Right bone of a male aged 47, showing the diploetic infantile type in the adult, type 1.

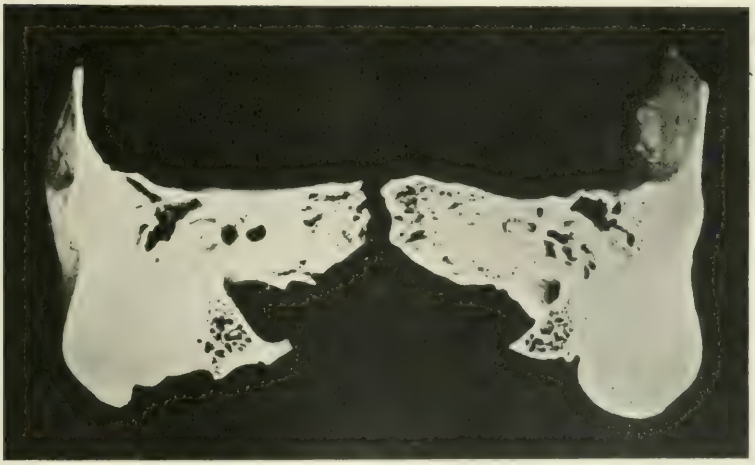

Fig. 4. Right adult bone, showing the dense infantile type in the adult, type 2.

may be of extreme thinness and translucency, and may have the cerebellum or lateral sinus, or both lying against it. In some specimens the posterior antral wall is pushed in by the cerebellum, thus narrowing the antral cavity from before backwards. As in all types the antrum may be highly placed, or the middle fossa may dip down either between the antral cavity and the surface, or external to the superior semicircular canal, causing a low flat antrum."

From this description, the operative difficulties that these types present are too obvious to require but passing men-

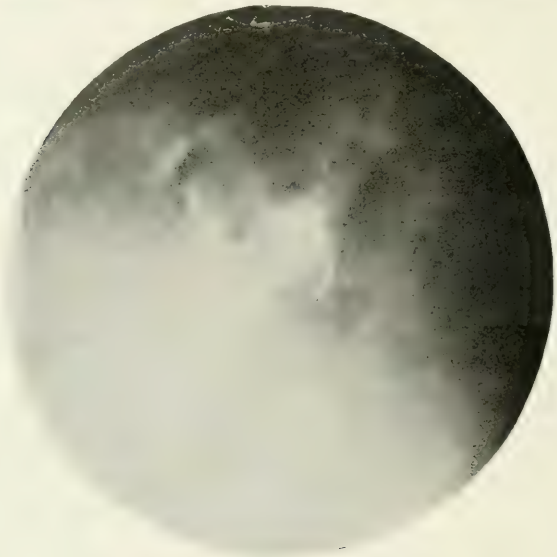

Fig. 5. A right infantile mastoid, probably type 2. Print from the pathological stereo-radiogram Case 1. Sinus found to be very superficial at operation.

tion. The antrum may be extremely difficult to find and in the necessary search, the sinus, the dura of either the posterior or the middle fossae and the facial nerve are all liable to injury.

As regards the clinical significance of these types Mr. Cheatle says the following: "It is obvious that an acute suppuration in the antrum may exist without any signs behind the ear, as it is impossible for pus to penetrate the outer antral wall or reach the mastoid process and that

there is a great liability for further serious extension especially to the posterior fossa if the posterior antral wall is very thin. If intracranial or labyrinthine infection does not occur in acute suppuration there is great chance of the suppuration becoming chronic; the lining membrane of the antrum undergoes destruction and degeneration, or some local destruction of part of the bony walls or ossicles takes place and causes a chronic discharge from the middle ear tract. . . . There is no doubt that the infantile types are found most frequently when operating for chronic suppuration."

This concisely summarizes the possibilities inherent in the "infantile" types of mastoid structure. An acute middle ear and antrum infection, occurring in these types, is likely to run a long subacute course with little or no objective evidence of mastoid involvement. Apart from otorrhea, drooping of the posterior superior canal wall may be the only clinical sign to indicate the necessity for operation. (Case 2). As type 2, except in the "outer antral wall", has no cell structure that can be infected mastoid tenderness and edema is even less likely to occur than in type 1. (Cases 2, 3). Although it be impossible for pus to extend directly from the antrum into the diploetic cells of the mastoid process in type 1, yet experience shows that infection of these cells does occur, probably through the blood and lymph channels. This infected cellular structure is often quite hard with a more or less gritty feel, and when, as frequently happens, it blends with the diploe of the surrounding bones, the complete excentration of infected cells is a difficult task. (Case 5). The typical signs and symptoms of mastoiditis may all be present in this type and continue indefinitely with periods of improvement followed by relapses, but at no time being as threatening as in the pneumatic types to be described later. (Case 5, Fig. 6).

Cases are seen occasionally in which there is exquisite tenderness over the mastoid, with or without thickening of the over-lying soft tissues, but without any history of

Fig. 6. A right infantile mastoid, probably type 1. Print from the normal stereo-radiogram Case 5. On the left side a type 1 infantile mastoid was found at operation.

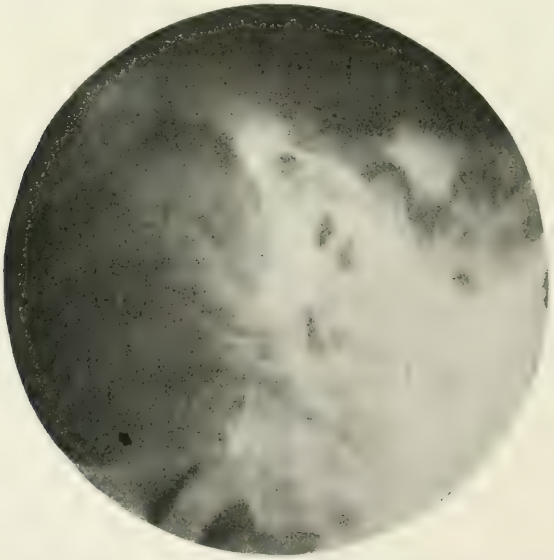

Fig. 7. A normal left infantile mastoid, probably type 2. Print from the radiogram Case 6, in which there was pain and mastoid tenderness without other evidence of middle ear or mastoid infection, probably hysterical.

otorrhea or any other objective evidence of middle ear or mastoid infection, and if the mastoid be explored, no infection will be found to account for these symptoms. In the writer's experience such cases usually have the infantile type of mastoid structure. (Cases 6, 7, Fig. 7).

From the anatomical studies above quoted, it seems reasonable to assume that either the diploetic or the dense type of "mastoid mass" is the one present at birth, pneumatic cells being formed by projections of the antral mucous membrane eroding their way into this primary mass or mastoid process. Stewart, [14] by the radiographic study of mastoids in children, has demonstrated that this process begins at an earlier age and proceeds with greater rapidity than had previously been supposed.

As Cheatle's work demonstrates that in 20 per cent. of all bones no pneumatic cells are to be found or, as he would express it, these cases retain the infantile type of structure throughout life, it seems probable that in a certain per cent. of all bones the pneumatic structure may be very rudimentary (Fig. 8, 9). Both the surgical experience of the writer and the examination of numerous radiograms, leads him to conclude that this supposition is correct and that adult mastoids of essentially infantile type do occur in which there is also a rudimentary pneumatic structure represented by a group of three or four large cells at the tip or some other locality. These mastoids have both clinical and surgical significance sufficient to warrant their classification as a distinct type.

Type 3. The mixed infantile and pneumatic mastoid with the infantile characteristics predominating. Mr. Cheatle apparently refers to this type of structure in the following words: "I wish to say that a dense outer antral wall does not always mean that cells (pneumatic?) are not present in the mastoid. For the outer antral wall may retain this infantile form, and a few cells may be present along the squamo-mastoid suture (Fig. 8), thus closely resembling the pure infantile type; . . . ; or a narrow tract may pass through the upper mastoid to large cells in the lower or

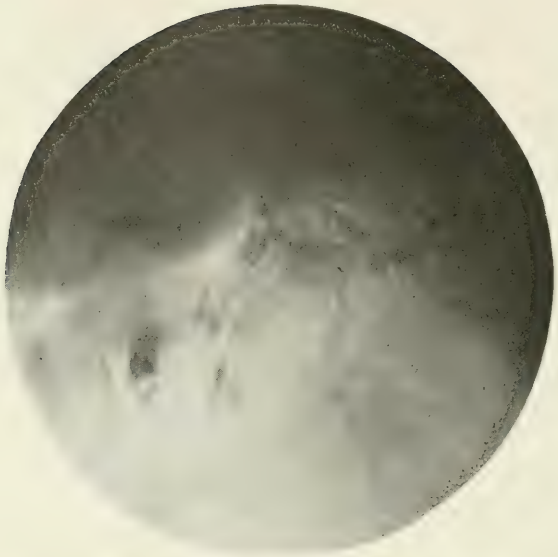

Fig. 8. A right infantile mastoid in a man aged 67, probably type 3. Print from the normal radiogram Case 8. A few large cells are seen in the tip and along the squamo-mastoid suture, probably rudimentary pneumatic structure. Compare with Fig. 9.

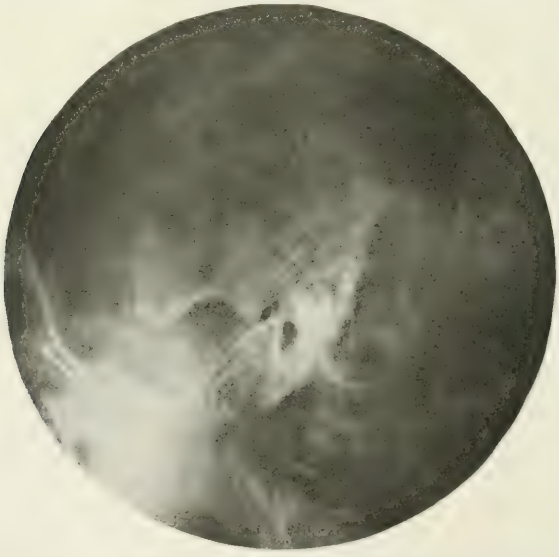

Fig. 9. A right normal mastoid in a girl aged 8, showing a few large scattered cells, probably rudimentary pneumatic structure. Compare with Fig. 8.

projecting part of the process (Fig. 8). A rare condition is for a dense outer antral wall to be associated with a narrow tortuous tract of cells with very dense walls running through the mastoid. I may say that if cells, apart from the 'foetal cell', are present in the outer antral wall they are also present to a greater or less degree in the mastoid."

From the above description it is evident that various combinations are possible. The cell structure of Case 8 possessed most of the dangers inherent in both the diploetic and the pneumatic celled mastoid with none of the safeguards of the latter type. This case was a type 2 or dense infantile mastoid with an isolated group of large cells imbedded in dense bone over the lateral sinus. Although in one of these cells the infection had eroded the bony covering of the sinus, yet there was no clinical evidence of this fact, the external cell walls being so dense that infection had but one direction in which to travel, namely, inward. Had it not been for the stereo-radiogram these cells would unquestionably have been overlooked at the operation with possible disastrous results easily to be imagined.

Case (3) (Fig. 10 a, b) demonstrates that the same individual may have a dense infantile mastoid on one side and a demonstrated anatomically by Mr. Cheatle [13].

Cheatle protests against the term "sclerosed mastoid," as applied to the infantile types. Sclerosis means a hardening due to some inflammatory process; in other words it is an active process akin to scar tissue formation. While it seems probable that under certain conditions sclerosis does occur in these types (Case 4), yet when the term "sclerosed" is applied indiscriminately to every small mastoid with a thick dense cortex and a fine dense cellular structure, it is evidently a misnomer.

In Case (4) (Fig. 11 a, b) the healthy mastoid shows in the radiogram a well marked pneumatic structure. In the diseased mastoid, there was found at operation a chronically infected antrum of moderate size deeply situated in dense bone that contained no cell structure. As no microscopic sections of the bone were made, it is of course

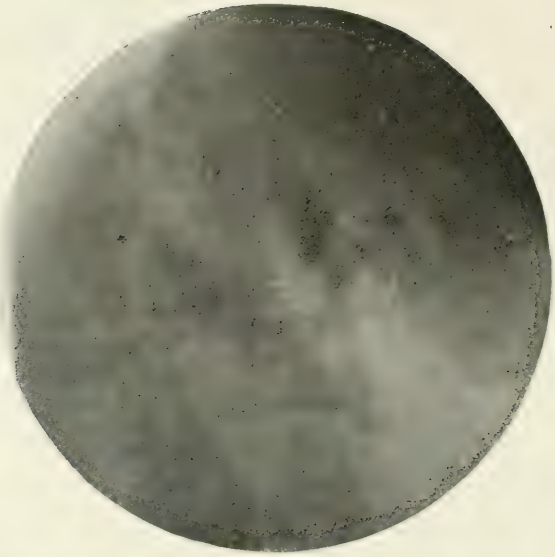

Fig. 10a. The left normal pneumatic mastoid Case 3.

Fig. 10b. A right type 2 infantile mastoid. Print from the pathological radiogram Case 3. This was interpreted before operation as a large broken down mastoid. Compare with Fig. 10a.

impossible to tell whether the density of bone was due to sclerosis from chronic infection or to persistance of infantile type, or both.

In the X-ray examination of the infantile types, the inherent limitations of radiography must be considered. As the radiogram is merely a record of densities, it must always be born in mind that the dense outer wall of the mastoid tends to obscure the small underlying cells. Where many cells are superimposed, they will show in the radiogram, otherwise they may not be apparent. It is therefore evident that the radiogram cannot be expected to show the exact details of cell distribution, although it will in most instances furnish a valuable clue as to the type of structure.

The radiogram, especially when a stereoscopic study is made, will practically always show the sinus to be far forward in the infantile types. When to this appearance is added a suggestion of cell structure towards the tip of the mastoid and a cellular area just back of the middle ear, the remainder of the mastoid appearing dense, in the writer's experience, type 1 is to be confidently expected (Fig. 3, 6). When the entire mastoid appears dense with the exception of a small cellular area, often but a faint suggestion, just behind the middle ear, type 2 is to be expected (Fig. 4, 5, 7, 11 b). When to one or the other of the above findings, there is added a small group of large cells, though they be but faintly outlined, type 3 is to be looked for and at operation the locality in which large cells are suspected should be thoroughly explored (Fig. 8).

The pneumatic mastoid can also be divided into three distinct types, the word pneumatic indicating a common characteristic, namely, that the cell structure is essentially air containing.

Type 1. The pure pneumatic type, practically all of the cell structure containing air. The usual structure of this type is as follows: The whole mastoid including the tip is large and well developed; the cortex is relatively thin; most of the cells are large in size with thin partitions, and are uniformly distributed throughout the mastoid (Fig. 12).

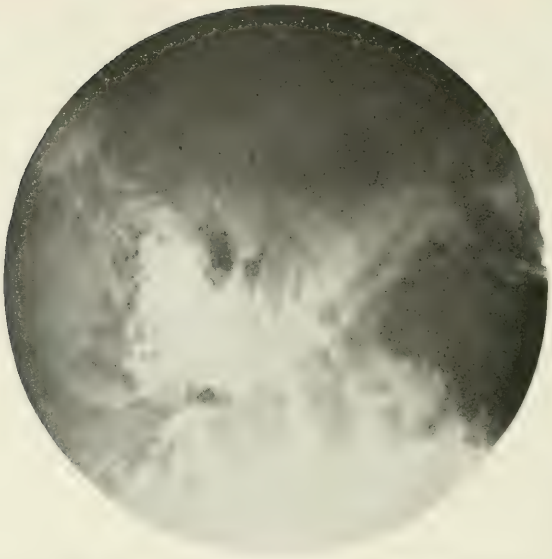

Fig. 11a. The right normal pneumatic mastoid Case 4.

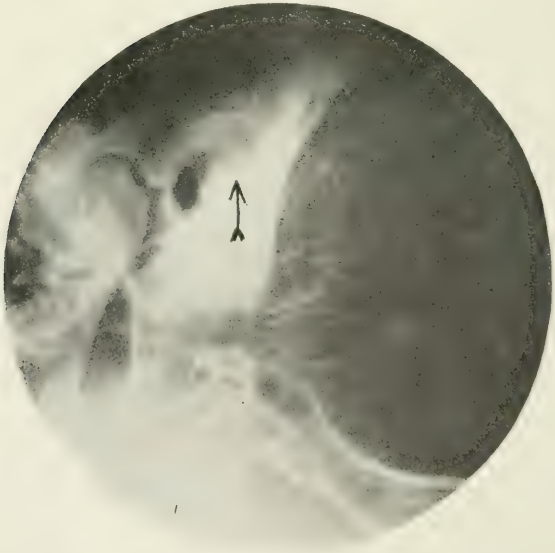

Fig. 11b. The left pathological mastoid Case 4. At operation a chronically infected antrum was found deeply situated in dense bone.

These features are by no means constant for occasionally the cortex may be of considerable thickness and density; instead of being limited to the mastoid, the cell structure may invade the occipital bone or the zygoma; while a large tip is the rule yet a mastoid with little or no tip development may be entirely pneumatic. As in all types the sinus is variable, although it is usually found well back and deeply situated.

It is a well known fact that mastoiditis with an abrupt onset of stormy and threatening symptoms, which may as promptly subside under treatment, is a common occurrence in large pneumatic mastoids. A middle ear or antrum infection can, in this type of mastoid, extend directly into the mastoid cells. On the additional fact that the cells contain air, can be based a physical theory to explain the clinical course of mastoiditis in the pneumatic types. As the air in all pneumatic or air containing structure is maintained at atmospheric pressure by more or less direct communication with the surrounding atmosphere, whenever this communication is interrupted for any length of time, the contained air is absorbed and a partial vacuum with consequent negative pressure results. In an acute suppurative otitis media, the infection first of all occludes the eustachian tube with resulting absorption of air and vacuum formation in the middle ear and mastoid cells; this in turn causes venous engorgement with consequent swelling of mucous linings and pouring of serum, the objective evidence that "nature abhors a vacuum." A fallow field is thereby prepared for the growth of bacteria and the infection spreads apace. This is shown clinically by the rapid onset of pain, mastoid tenderness and occasionally edema. Pain and tenderness may be present before there is any objective evidence of infection in the middle ear (Case 10). (Fig. 20 a, b). It seems reasonable to assume that incision of the drum membrane, not only provides drainage for the mastoid, but also tends to restore atmospheric pressure and abolish negative pressure in the mastoid cells, this of itself tending to reduce the edema and swelling of the mucous membranes

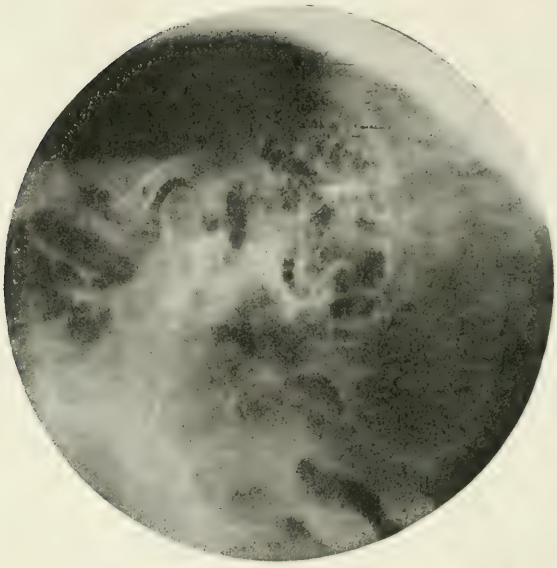

Fig. 12. A left pneumatic mastoid, probably type 1. Note the relation of the middle ear, aditus and antrum.

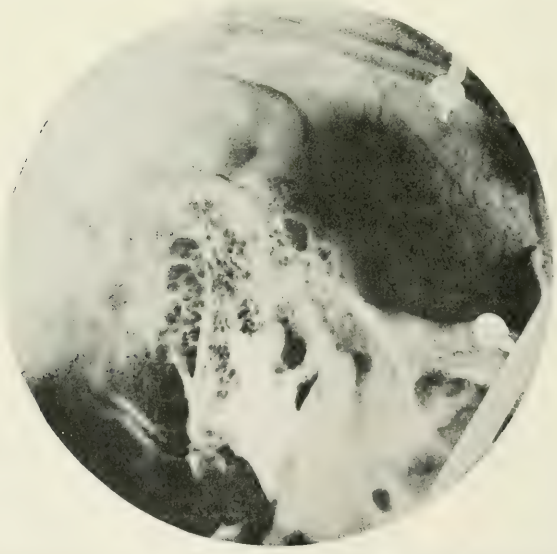

Fig. 13. Print from a stereo-radiogram of a skull, showing zygomatic cells extending to the tempero-mandibular articulation.

and the general venous engorgement. The ground, so to speak, is thereby knocked from under the infection, and unless the general resistance is too low, or the infection too virulent, or too much damage has already resulted, the stormy and threatening symptoms promptly subside and the case recovers, often with surprising rapidity. (Case 9). (Fig. 14 a, b). When resolution does not take place, clinical signs and symptoms will usually furnish ample evidence of this fact.

However, experience shows that considerable destruction of cell structure can occur without clinical signs or symptoms, or these signs and symptoms may make their appearance late in the course of the infection. There are two structural possibilities to explain these occurrences. The cell walls may be so thin and fragile that destruction of cell structure causes little or no local reaction, or the signs and symptoms of mastoiditis may be obscured by an unusual thickness and density of cortex. (Cases 11, 12).

Cells may extend so deeply into the occipital bone or into the zygoma, that without fore knowledge of their presence, they may be overlooked at operation and failure of healing or intracranial complications result. Figures (13, 14 a, b) show how closely zygomatic cells may approach the tempero-mandibular articulation. Mastoid infection under these conditions could easily invade the joint cavity.

The type 1 pneumatic mastoid is the easiest and most satisfactory of all types to radiograph, for unless the cell structure has been entirely destroyed, the radiogram will demonstrate the exact details of cell distribution and of pathology as well. As pathological appearances have been well described by previous observers they will be given but passing mention. An early stage of mastoid infection is indicated in the radiogram by a general haziness and a blurring of cell outlines with here and there an apparent breaking down of individual cell partitions (Fig. 14 b). Cases with this X-ray appearance may or may not resolve. When resolution does not take place, a later plate will show more disintegration of cell partitions and

Fig. 14a. The right normal mastoid Case 9, showing zygomatic cells nearly surrounding the tempero-mandibular articulation. Compare with Fig. 13.

Fig. 14b. A left pneumatic mastoid, probably type 1. Print from the pathological radiogram Case 9. Zygomatic cells are seen extending to the tempero-mandibular articulation. There is general haziness of cells and apparent destruction of cell walls in the upper two-thirds.

considerable cloudiness generally, while a still later appearance shows even more cloudiness with only occasional fragments of cell outline. Unless the radiogram is of the highest technical quality and the observer not only has a thorough knowledge of mastoid radiograms but also makes a careful study of each individual plate, this latter appearance may be confused with the X-ray appearance of the infantile types or visa versa, and an entirely wrong interpretation result. (Case 3) (Fig. 10 a, b).

Type 2. The mixed infantile and pneumatic type with the characteristics of the latter predominating. From the clinical point of view, the distinctive characteristic of this type would seem to be the presence of sufficient pneumatic structure for negative pressure to play a part in the spread of infection. It is, of course, obvious that in some cases this type cannot always be distinguished by the radiogram from the type 3 infantile mastoid, on the one hand and the type 1 pneumatic mastoid on the other. Figure 15 shows a cross sectioned temporal bone whose cell structure is largely pneumatic. In the tip directly under the cortex is a nest of large diploetic cells separated from the pneumatic structure by a layer of compact bone. Figure 16 shows this cell nest as revealed by the radiogram. When viewed stereoscopically its separation from the pneumatic structure is quite apparent. Mr. Cheatle has demonstrated that at birth the diploetic or "fetal" cells of the "mastoid mass" are separated from the antrum by a layer of compact bone (Fig. 1). In the above specimen, the pneumatic cells, in their development from the antral mucous membrane, instead of penetrating this original layer of compact bone have apparently pushed both it and the underlying diploetic cells into the tip.

Although an acute infection occurring in this mastoid would undoubtedly run the same clinical course as in the type 1 pneumatic mastoid, yet its surgical importance would be greatly increased by the nest of diploetic cells separated by dense bone from the pneumatic structure. Though infection of this cell nest by direct extension and negative

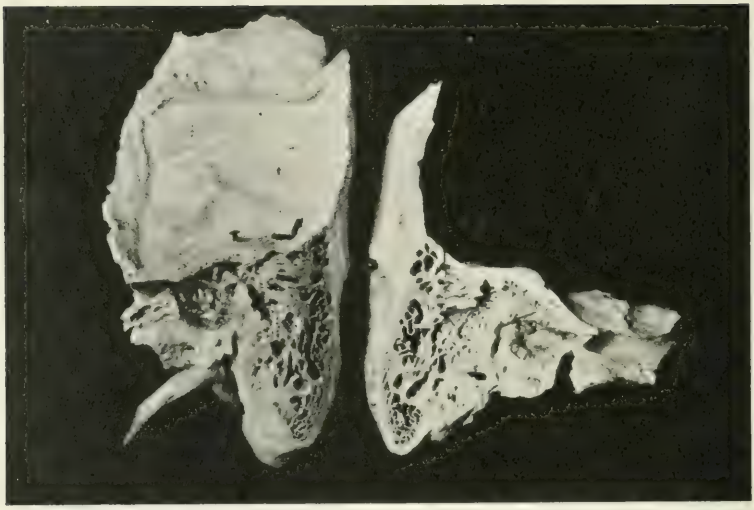

Fig. 15. Photograph of a bone showing a nest of large diploetic cells in the tip separated from the pneumatic structure by a layer of compact bone. Compare with Fig. 16.

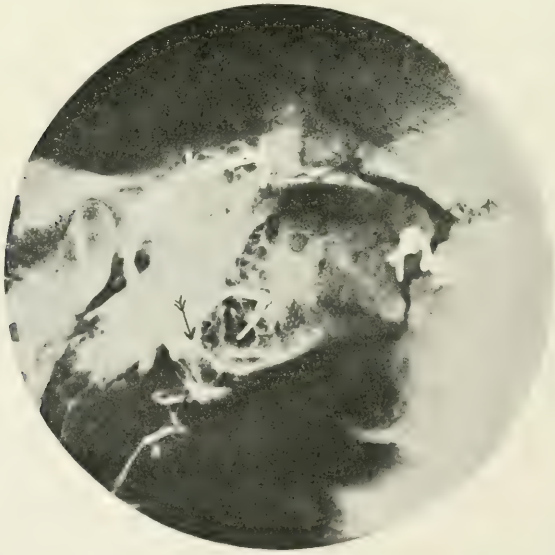

Fig. 16. Print from stereo-radiogram of the bone shown in Fig. 15. Arrow points to nest of diploetic cells in the tip separated from the pneumatic structure by a layer of compact bone. This is even more evident when viewed stereoscopically.

pressure be impossible, yet infection through the blood and lymph channels would be not only possible but probable, and unless infection had eroded the bony partition, or the tip were removed at operation, this cell nest might easily escape notice and remain undrained, a possibility at variance with the often expressed opinion that even though all of the cells are not removed at operation, those that remain will have adequate drainage.

Although some photographs (13) of Mr. Cheatle's specimens apparently show a layer of compact bone separating diploetic from pneumatic cells, yet no general conclusions can be drawn from the limited material at hand. Whether or not diploetic and pneumatic cell structure is often or always separated in this manner, is a question that cannot be answered without further investigation. As a practical measure it would seem prudent to thoroughly explore at operation every area in which the radiogram revealed the presence of diploetic cells. For this purpose the stereoradiogram is the only reliable guide, as many large cells superimposed may in the single plate simulate diploetic structure (Fig. 17 a, b).

Type 3. The "double decked" mastoid. This term is used at the Massachusetts Charitable Eye and Ear Infirmary to describe those mastoids in which the cells are arranged in two tiers separated one from the other by a bony septum which in location and general appearance often closely resembles the internal table. Case 13 is a remarkable demonstration of the surgical importance of this type.

The writer performed a left mastoid operation about five years ago on a man aged 69, referred by Dr. R. S. Phillips, in which this type of structure was well marked. In this case, signs and symptoms of mastoiditis sufficient to warrant operation were slow to appear, and as satisfactory radiograms of the mastoid were then unobtainable none were taken. At operation removal of a very thick dense cortex disclosed a considerable amount of large necrotic cells filled with pus and granulations, the removal of which left a cavity of average size and depth. On investigation of what

Fig. 17a. Print from stereo-radiogram of a left normal pneumatic mastoid, pobably type 1.

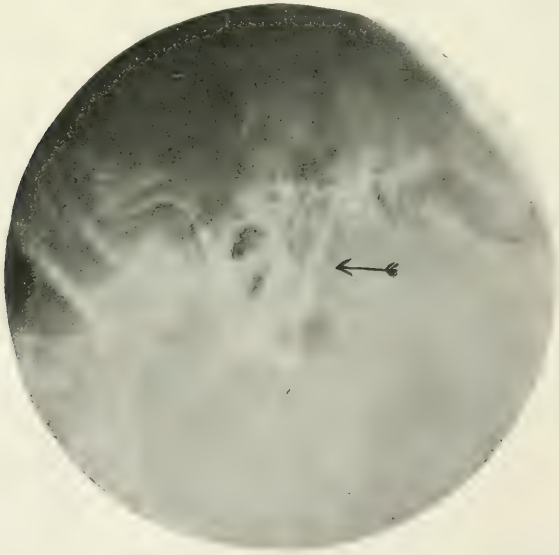

Fig. 17b. The right normal mastoid of same individual as Fig. 17a. Arrow points to apparent diploetic structure. Study of the stereoscopic plates shows that this is really many large pneumatic cells superimposed.

appeared to be the internal table there was found some areas of softening leading into cells underneath, removal of this false inner table revealing another tier of necrotic cells, which when curetted out left a cavity of unusual depth.

Figure 18 is a radiogram of the normal mastoid in this case taken recently by Dr. Gerber. The single plates apparently show a mixed diploetic and pneumatic structure which when viewed stereoscopically appears to be arranged in two separate tiers one over the other. The outer tier, composed of large pneumatic cells, begins at the cortex and apparently occupies the larger part of the mastoid process, while the inner tier, composed of small diploetic cells, extends deeply into the posterior part of the pyramid. No bony septum can be made out although one might be present and yet not appear in the radiogram. As the left mastoid had the typical double decked arrangement of cells, it is quite likely that the same arrangement is present in the right. It is, therefore, possible that this type of mastoid may have the same development as was suggested in reference to the nest of diploetic cells in Figures 15 and 16.

As previously pointed out, in the bone from which these figures are taken, the "fetal" diploetic structure and the layer of compact bone separating it from the antrum has apparently been forced into the tip by the development of the pneumatic cells; had these cells, in their development, proceeded directly to the cortex and then down into the tip without penetrating the "fetal" layer of compact bone, the diploetic cells would then have been found in the depth of the mastoid, separated from the overlying pneumatic structure by a layer of compact bone; or had the reverse taken place, that is, had the pneumatic cells occupied the depth of the mastoid and forced the diploetic structure underneath the cortex, we would have, in either event, "double decked" mastoid. Much more investigation is, of course, necessary to determine if this be the correct explanation for the occurrence of this type.

In all probability this type of structure can never be conclusively demonstrated by radiography, yet whenever

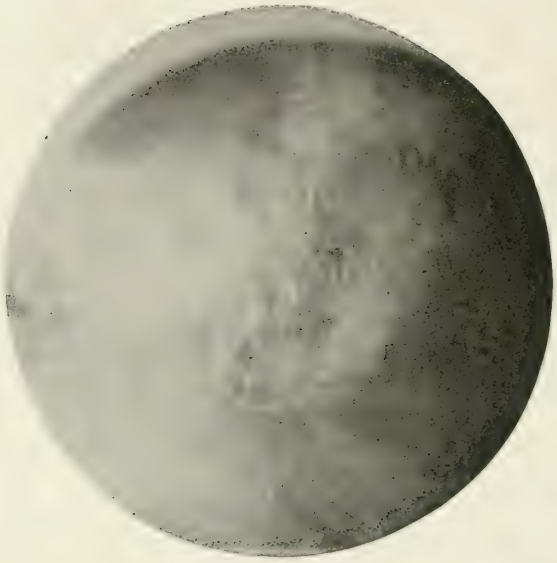

Fig. 18. A right mastoid, showing mixed diploetic and pneumatic cells. Stereoscopic study shows probable double decked arrangement with diploetic cells underneath and pneumatic cells external.

Fig. 19. Operation cavity left mastoid. Print from stereoradiogram Case 7. Arrow points to infected residual cells in floor of cavity overlying sinus. This is shown very clearly when viewed stereoscopically.

the stereo-radiogram shows diploetic cells deeply situated (best seen by reversing the plates 15) the possibility of the "double decked" mastoid should be borne in mind.

As reference has been made from time to time to the necessity of securing radiograms of good technical quality, it seems well to state briefly just what this term implies. The writer has asked Dr. I. Gerber, to whose skill and co-operation he is greatly indebted, to state in a general way how satisfactory X-ray examination of the mastoid is made, and how the quality of a plate is determined.

"In the radiographic study of the mastoid, plates are generally taken in two projections, the antero-posterior and the lateral-oblique. The antero-posterior projection sometimes is made so that both mastoids are taken at one exposure. As modified by Hickey however, each mastoid is exposed separately on one half of a plate with the same technique, and with a very small cone, so that the greatest possible definition is obtained. While the evidence from this projection is limited, still it is important as a supplement to that obtained by the other exposures. A general idea is had of the depth of each mastoid, of the gross distribution of cells and diploe, and of the rough air content of each side. The finer details of mastoid structure and topography can only be seen on the lateral-oblique plates. These are taken with the central ray passing through the vertex of the skull at such an angle as to project only the mastoid on the under side on to the plate. The usual custom has been to expose each mastoid in this way, often on separate halves of a single plate. If the exposures are made with the same technique, a good opportunity is afforded to compare the details of the two mastoids side by side.

With the single flat plates of this sort, however, the information is much limited. If one side is normal, the study of the diseased side is facilitated otherwise it is difficult. The contrast between air content on one side and haziness on the other can be easily noted. Destruction or thickening of the cell-walls can often be seen. But the finer details of mastoid structure, such as the exact distribu-

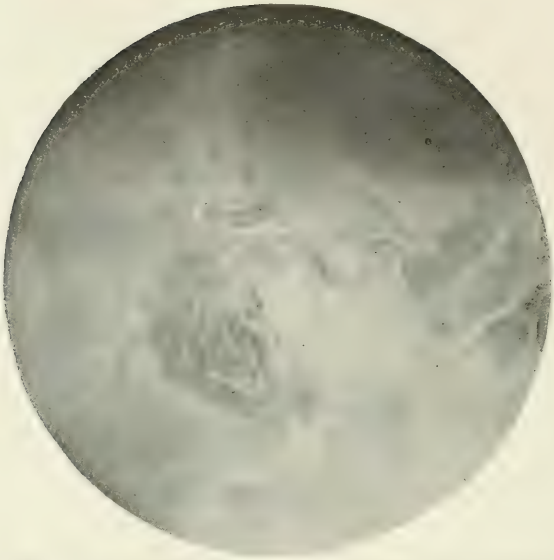

Fig. 20a. The normal left pneumatic mastoid, probably type 1, Case 10. Emissary vein shows very clearly.

Fig. 20b. Print from stereo-radiogram of right mastoid, Case 10. Posterior portion and tip shows probable sclerosis with a few scattered hazy cell remnants. Compare with Fig. 20a.

tion of pneumatic cells and diploe, the exact relations of the sinus, the presence of partly sclerosed cells, etc., all of which are of the utmost clinical importance, can only be obtained accurately by the study of stereoscopic plates of each mastoid. Many points which are doubtful from a study of the flat plate are cleared up with certainty by the stereoscopic study. In short the advantages of stereoscopic study of the mastoid are those which accrue to stereo-radiography in general, and which have caused the marked increase in the use of stereoscopic rather than flat plates wherever practicable.

An estimation of the technical quality of plates of the mastoid region is of extreme importance. When some or all of the mastoid cells are pneumatic, the character of the cell detail will furnish an index of plate quality. In a good plate the normal cells should be definitely black, with sharp and clean-cut walls. If there is any generalized disease process, other portions of the plate must be considered in judging quality. The tempero-mandibular joint, the auditory canal, and the lateral sinus are all regions that must be studied. They should be sharp and clear cut in a properly exposed and developed plate. The bone of the mandible should show its structure well-defined. In addition, the character of the detail of the skull generally and of the sutures is of value. The ability to judge these points is of especial importance when examining stereoscopic plates, as we then have at least four plates developed separately. The use of the Coolidge tube is an aid in obtaining uniform exposures. A complete X-ray examination of the mastoid therefore consists of a stereoscopic set of plates of each mastoid in the lateral-oblique diameter, and one exposure of each mastoid in the antero-posterior diameter."

The writer would add in conclusion that an X-ray examination of this character and quality will in most instances reveal the type of mastoid and that this information should enable the observer to predict the clinical course and the prognosis of a middle ear infection with greater exactness, and place therapeutic measures on a more scientific and less

emperical basis. For example, if the X-ray examination shows the mastoid to be one of the infantile types, the observer is thereby informed that in the case under consideration mastoid symptoms may not appear or may be very indefinite, and that the middle ear infection is quite likely to become chronic; forewarned by this knowledge, he should prevent this contingency by early drainage of the antrum regardless of the absence of the classical indications for the performance of this operation. If, on the other hand, the radiogram shows the mastoid to be one of the pneumatic types the observer should not hasten the patient to the operating table at the onset of stormy and threatening mastoid symptoms, but should remember Schwartze's dictum that barring unusual symptoms, acute mastoids do not require operation unless the stormy mastoid symptoms continued unabated longer than eight days after incision of the drum membrane; in other words, he should wait a sufficient length of time for the re-establishment of atmospheric pressure within the mastoid cells.

As to the objection to routine X-ray examination on the ground of expense to the patient, if the otologist is fully convinced in his own mind of its usefulness and necessity he should have little difficulty in convincing the patient, especially as the average individual has an exaggerated idea of what may be learned from X-ray findings, and has besides a greater dread of a mastoid operation than of almost any other surgical procedure. X-ray examination is not necessarily unavailable for very sick patients in private houses, as Case 12 demonstrates.

The following cases, which have been referred to from time to time, have been selected to illustrate the clinical and surgical significance of different types of mastoid structure with special reference to their determination by means of the roentgen-ray:

Case 1. A forward and unusually superficial sinus, occurring in an infantile mastoid (probably type 2).

Hospital patient, a young woman aged 19, admitted to the Rhode Island Hospital October 28, 1917, for a purulent dis-

charge from the right ear of three years duration. The stereo-radiogram showed what appeared to be an infected type 2 infantile mastoid with the sinus far forward, the usual location in this type. At operation retraction of the soft tissues revealed a bluish spot about half the size of a dime at the posterior border of the supra-meatal triangle. As this spot gave the appearance of necrotic bone, it was investigated with the bone searcher, which to the writer's chagrin plunged through a delicate film of bone into the sinus, the ensuing hemorrhage necessitating a "strategic retreat." The initial incision was close to the auricle, otherwise the sinus would in all probability have been opened with the first cut of the scalpel. On again looking at the stereo-radiogram, the sinus was seen to show with unusual distinctness, due of course to the thinness of the bony covering. (Fig. 5.)

Case 2. An acute middle ear and mastoid infection occuring in a type 2 infantile mastoid.

Private patient, a young man aged 19, referred by Dr. Halsey DeWolf, April 1, 1915. This case ran a subacute course for a month before it was finally operated. When seen first, patient had had pain in the right ear for twenty-four hours. There were two or three blebs on the drum membrane, but no general redness and bulging. These blebs were incised and although the pain did not recur, yet as the drum membrane without definite bulging gradually became red and thickened and a slight serous otorrhea persisted, the drum was incised a few days later. After a week the otorrhea which remained serous had nearly ceased, when the pain suddenly recurred, accompanied by distinct bulging of the drum membrane. The incision this time was followed by a moderate mucopurulent otorrhea that neither increased nor diminished. After about ten days some drooping of the posterior superior canal wall developed, this and the persistent otorrhea being the only clinical evidence of mastoid infection. A radiogram taken by Dr. Gerber showed an infected type 2 infantile mastoid, these findings being confirmed at operation.

The cortical surface of this mastoid had a warped appearance due to an irregularly triangular depression or wrinkle about an inch directly back of the supra-meatal spine. The cellular structure consisted of a few scattered cells directly under the supra-meatal triangle, the rest of the mastoid being entirely dense. The sinus was far forward and was exposed in the search for the antrum which was very small. The middle ear was entirely dry within a week after the operation and the hearing which had been much affected promptly returned to normal. It is this type of mastoid, one of the typical infantile types, that is often spoken of as atypical, or sclerosed.

Case 3. An infected type 2 infantile mastoid on the right and a large normal pneumatic mastoid on the left side.

Private patient, a young man, referred by Dr. James Gilbert, May 27, 1916. Five months previously patient had an attack of "la grippe," at which time an otorrhea developed in the right ear and continued till five weeks ago, when it suddenly ceased. One week ago a swelling suddenly developed in the right side of the neck just below and back of the ear. The drum membrane was found to be dark red in color and much thickened but without bulging or perforation. Low conversational voice was heard at 2 feet. There was a hard non-fluctuating swelling the size of a tangerine just below the mastoid and under the sterno-mastoid muscle. A radiogram was taken by Dr. Gerber which was misinterpreted by both him and the writer. As a large pneumatic mastoid was apparent on the left side, this fact together with the clinical history and examination led us to interpret the appearance of the right side as a large broken down mastoid probably filled with pus and granulations. (Fig. 10 a, b). Patient insisted on delaying operation for a week, during which time the swelling in the neck entirely disappeared.

At operation the warped appearance of the cortex as described in Case 2 gave warning of a forward sinus, the first chip of bone removed exposing the same. The cellular distribution was exactly the same as in Case 2. Although

there was no pus, the sinus was found to be covered with granulations for about two-thirds of an inch. The mastoid wound was entirely healed within ten days, and the drum membrane which had been incised at operation within two days, the hearing promptly returning to normal. Further study of the radiograms convinced us that had we not been over-influenced by the clinical history, the apparent Bezold abscess, and the radiogram of the left mastoid, we would not have misinterpreted the findings. (Fig. 10 a, b).

Case 4. A chronically infected antrum deeply situated in dense bone on the right, a normal pneumatic mastoid on the left side.

Hospital patient, a young man aged 26, admitted to the Rhode Island Hospital April 19, 1917. The right ear had discharged continuously for 15 years. Three weeks before admission patient had an increase in otorrhea, accompanied by pain and mastoid tenderness as a result of an attack of "la grippe", and one week before admission began to have attacks of vertigo nausea and vomiting, the labyrinth tests indicating that these symptoms were due to pressure and not to labyrinthine infection or fistula. Examination further disclosed a profuse foul otorrhea, a middle ear filled with tough granulations, drooping of the posterior superior canal wall and tenderness over the antrum but no mastoid edema. The radiogram showed a large pneumatic mastoid on the left side, while the right mastoid appeared entirely dense except for a light area the size of a dime just above and behind the middle ear (Fig. 11 a, b).

At operation (radical) a large antrum corresponding to the light area was found deeply placed in dense bone that contained no cellular structure, the antrum attic and middle ear being filled with tough and adherent granulations. No bone was examined microscopically so it is impossible to tell if the density of bone was due to sclerosis or to persistence of infantile structure or both.

Case 5. A middle ear and mastoid infection of nine months duration in a type 1 infantile mastoid.

Hospital patient, a girl aged 14, admitted to the Rhode Island Hospital October 12, 1917. Mother died of tuberculosis and patient was treated at a camp two years previously for "T. B. of the throat", although there are no active signs at present. For the past nine months has had more or less pain in the left ear and a continuous otorrhea. Examination showed a fairly profuse somewhat foul purulent discharge coming from a large perforation in the anterior inferior quadrant, some drooping of the posterior superior canal wall and well marked tenderness over the entire mastoid. The stereo-radiogram showed probable infection of a type 1 infantile mastoid (Fig. 6). The symptoms began to subside the day after admission and at the end of ten days the middle ear was entirely dry and the mastoid tenderness and drooping of the canal wall had disappeared. Patient was discharged from the hospital and returned five days later with conditions the same as on first admission, pain and otorrhea having recurred the day after leaving the hospital.

At operation, the removal of a thick dense cortex disclosed a small diploetic celled mastoid. As the antrum was approached this cellular structure ceased and hard dense bone was encountered. All of the cell structure was hard and resistant and merged posteriorly with the diploe of the occipital bone; the cells in the body of the mastoid and tip were filled with dark red serum but contained no granulations. As there was some bare bone at the entrance of the eustachian tube this case may come to radical operation. At the present writing the middle ear is dry and the mastoid wound healed.

Case 6. Pain and mastoid tenderness without any other signs of infection occurring in an infantile mastoid.

Private patient, a young woman aged 17, seen in consultation with Dr. C. J. Astle. Two years previously had had an otorrhea in both ears lasting about six weeks. For the past ten days has had severe pain and tenderness over the left mastoid with no other signs of middle ear or mastoid infection. A radiogram of the left mastoid was reported

as showing evidence of infection sufficient to warrant operation while that of the right mastoid was said to be too poor a plate to show anything definite. Other radiograms taken a few days later by Dr. Gerber showed two infantile mastoids both of which were apparently normal (Fig. 7). Patient was assured that operation was not only unnecessary but would not even be considered. The pain and tenderness disappeared a few days later. This case shows the danger of basing definite conclusions on X-ray appearances unless both plates be of good quality.

Case 7. Pain, mastoid tenderness and edema occurring in an uninfected type 1 infantile mastoid.

Hospital patient, a young woman aged 21, admitted to the Rhode Island Hospital, September 12, 1917. Case reported by the courtesy of Drs. L. B. Porter and H. P. Abbott. This patient had complained of severe pain and tenderness back of left ear for over a week. Examination showed an area of swelling, redness and tenderness beginning about three-fourths of an inch behind the left post-auricular fold and extending about the same distance backwards and over an inch downward. There was no tenderness over the antrum or tip or any other evidence of middle ear or mastoid infection. The radiogram showed what appeared to be a normal type 1 infantile mastoid. Because of the persistence of the pain and tenderness, an exploratory mastoid operation was performed, removal of a thick dense cortex, disclosing uninfected diploetic cells throughout the mastoid. The wound was closed without drainage. Pain and tenderness were nearly gone at the end of the week, when the wound became infected and had to be drained. As the wound did very poorly, a stereo-radiogram was taken three weeks later, that revealed infected diploetic cells in the floor of the cavity overlying the sinus, this X-ray appearance being confirmed at the second operation. (Fig. 20.) At the present writing this case is making a slow but uneventful recovery. This case shows that an exploratory mastoid operation may be attended by bad results, and that a mastoid radiogram,

preferably a stereo-radiogram, is indicated whenever a mastoid wound does not heal readily.

Case 8. A middle ear and mastoid infection occurring in a type 3 infantile mastoid.

Hospital patient, a man aged 67, admitted to the Rhode Island Hospital August 11, 1917. Hospital record before coming under the writer's observation, reported by courtesy of Dr. L. B. Porter. About two months ago patient developed bilateral deafness over night. For two days had pounding like piston rods in both ears when both began to discharge a thin whiteish fluid, this discharge stopping spontaneously within two days. Since then the right ear has been practically normal, but the left ear has remained very deaf. About three weeks later, patient began to have pain and swelling back of the left ear, both of which have persisted, the pain during the past ten days being so severe as to allow but little sleep. Examination of the left ear showed a drooping of the posterior superior canal wall so marked that the drum membrane could not be seen, and a large, red, fluctuating swelling over the mastoid, incision of which evacuated a large amount of pus. The radiogram taken later showed probable infection of the left mastoid, but no definite details. (Fig. 8.)

Patient remained in the hospital for some time but refusing operation was discharged to the Out-Patient Department from where he was readmitted, coming under the writer's care about two months after first admission. At this time examination of the left ear showed a somewhat thickened drum membrane and some drooping of the posterior superior canal wall and a small sinus just back of the auricle, discharging a small amount of pus. Bare bone could be felt at the bottom of this sinus. The stereo-radiogram was of such poor quality that the consulting radiologist, Dr. Gerber, declined to give any opinion. While nothing definite could be made out in the single plates, yet when placed in the stereoscope, the writer thought he could distinguish a group of large cells some distance directly posterior and a little above the upper margin of the middle ear.

At operation a perforation of the cortex leading into the antrum was found in the supra-meatal triangle together with a small amount of diploetic structure, the mastoid process below being entirely dense. On exploring the region in which the large cells were suspected four large cells filled with granulations were found nearly two inches posterior and a little above the supra-meatal spine deeply imbedded in dense bone, no cell having any apparent connection with any other cell. (Fig. 8). The deepest and most posterior cell, about the size and shape of a white bean, was situated over the sinus apparently back of the knee, the bony covering of the sinus being absent and the cell containing several drops of thick pus under pressure.

The case made an uneventful recovery with almost complete restoration of hearing. As the posterior cells in this case were far too large to be diploetic cells, it therefore seems reasonable to assume that this group of cells was a rudimentary pneumatic structure. The radiogram of the normal mastoid shows large cells in this same region and also two or three large cells in the tip. (Fig. 8).

Case 9. An acute middle ear infection with well defined signs and symptoms of mastoid involvement occurring in a large pneumatic mastoid, probably type 1.

Hospital case, a man aged 37, admitted to the Rhode Island Hospital, May 8, 1917, case reported by courtesy of Dr. H. P. Abbott, the radiograms of both mastoids being more striking than any in the writer's collection. (Fig. 14 a, b). For three day previous to admission patient had complained of severe throbbing in the left ear, that made sleep impossible. Examination showed redness and bulging of the drum membrane and drooping of the posterior superior canal wall, and tenderness over the mastoid, incision of the drum membrane evacuating a large amount of bloody serum. Three days later patient complained of much pain and tenderness over the mastoid; evening temperature over 101°. Radiograms were taken that showed evidence of infection in the left mastoid. (Fig. 14 a, b). Three days later the otorrhea was purulent and very profuse, the pain and tem-

perature being less but the tenderness remaining the same. Within the next three days all mastoid signs and symptoms had disappeared and the otorrhea had practically ceased, patient being discharged from the hospital.

This case illustrates how quickly stormy and threatening mastoid symptoms may subside in large pneumatic celled mastoids.

Case 10. A middle ear and mastoid infection occurring in a pneumatic mastoid, probably type 1. Disappearance of clinical signs with unresolved mastoid infection demonstrated by roentgen examination.

Private patient, a woman aged 45, seen in consultation with Dr. F. T. Fulton March 2, 1914. Patient had developed tonsilitis two days previously, complaining of severe pain in the right ear for the past twenty-four hours. As the ear examination was entirely negative the pain was ascribed to otalgia from the right tonsil, which was found to be inflamed and swollen. The following day the pain had increased in severity, examination revealing well marked mastoid tenderness on deep pressure especially at the tip. The drum membrane, except for a slight blueness, appeared the same as on the day previous. Because of the pain and tenderness the drum was incised and several drops of serum evacuated. The following day there was a copious otorrhea, the drum membrane was red and thickened, the clinical signs and symptoms of an acute and threatening mastoid infection being unmistakable. These symptoms persisted for several days and then gradually disappeared. Eighteen days after incision of the drum membrane the middle ear was dry and all clinical signs of mastoiditis had disappeared. Some impairment of hearing remained, patient complained that the ear felt stuffy and the mastoid felt "stiff and lame." As inflation through the eustachian catheter improved the hearing somewhat but did not relieve the subjective symptoms X-ray examination was advised, not with the idea that anything pathological would be found but that negative findings would have a beneficial mental effect.

A radiogram, taken by Dr. Percy Brown a month later, much to the writer's surprise, showed the right mastoid to be quite cloudy as contrasted with the left, this cloudiness being most marked in the tip and the posterior cells. On the strength of this finding a mastoid operation was advised but refused. A radiogram taken some months later showed apparent clearing up of the upper part of the mastoid, the posterior portion and the tip remaining cloudy. A stereo-radiogram taken recently by Dr. Gerber shows the upper portion of the mastoid to be pneumatic, while in the posterior portion and the tip the cells are almost entirely obliterated. An unusual density of the petrous bone is also shown (Fig. 20 a, b). This does not seem to have any especial significance for at present the hearing in the left ear is normal, while in the right ear the patient hears a whisper at 3 feet, the test otherwise being practically the same as in the right.

This case shows that subjective mastoid symptoms when accompanied by loss of hearing are significant and should not be treated lightly.

Case 11. A double middle ear and mastoid infection, both mastoids having large cells widely distributed and a very thick dense cortex. Latent mastoiditis in the right, a slow development of signs and symptoms in the left.

Private patient, a young man aged 22, seen in consultation with Dr. A. Corvese December 21, 1916. Patient developed influenza eight days previously that was followed four days later by pain in both ears and a slight bloody discharge that stopped within two days, the pain in the ears persisting and the temperature remaining between 101 and 102 . Examination showed redness and thickening of both drums, incision allowing the escape of thick pus. There was no mastoid tenderness. Patient was next seen in the writer's office January 6, 1917. Otorrhea had continued but temperature had remained normal after the drum incisions. Patient had developed tenderness in both mastoids but while that in the right promptly subsided, slight tenderness remained in the tip of the left. Patient also developed

severe shooting pains in the left occipital bone which have persisted. A moderate mucopurulent discharge was found in both ears. On the right side, except for the persistent otorrhea, there were no signs of mastoid involvement but on the left side there was slight drooping of the posterior superior canal wall, slight tenderness at the tip, and a spot of exquisite tenderness in the occipital bone at a point half way between the auricle and the occipital protuberance, which from its location was thought to have no relation to the mastoid. Infection of the left mastoid was considered probable and a radiogram advised which was not taken till January 23.

The radiograms showed both mastoids to be very large with extensive posterior prolongations and a general destruction of cell structure, apparently as wide spread in the one as the other. Patient did not consent to operation till a week later when he was admitted to the Rhode Island Hospital. Since the examination three weeks before, the left mastoid including the posterior superior canal wall had become very edematous, the otorrhea being also increased. The discharge from the right ear had remained about the same, and no tenderness or any other sign of mastoid involvement had developed except a slight drooping of the posterior canal wall.

At operation the anatomical structure and the pathological changes were practically the same in both mastoids. There was found externally an absence of tip development and a warped appearance of the cortex similar to that found in the type 2 infantile mastoids (Cases 2, 3). Removal of an unusually thick and dense cortex revealed an almost complete destruction of cell structure and internal table. Posteriorly the cells were found grouped into nests having thick dense partitions. These nests all opened into the body of the mastoid but had no apparent communication with each other. An enormous nest of necrotic cell structure was found extending deeply into the occipital bone. On the left side this cell extension reached the point at which exquisite tenderness had been discovered three weeks

previously. Both middle ears were dry on the third day and both mastoids were entirely healed within two weeks.

This case shows the value of X-ray examination in cases of continued otorrhea following middle ear infection.

Case 12. A double middle ear and mastoid infection occurring in an eight year old child. Both mastoids of large size and having a cortex of unusual thickness and density.

Private patient, a girl aged 8, seen in consultation with Dr. J. W. Mitchell. Patient and a sister aged 10 had developed influenza the day previously, the older sister running a temperature from 102° to 104° for nearly a week with no ear symptoms whatever.

Patient had complained of pain in the left ear for twelve hours, examination showing a red and bulging drum, incision of which was followed by the escape of bloody serum. The right drum appeared normal but was incised the following day because of beginning redness and bulging. The temperature ranged from 100° to 105° for the next three days, but apart from a copious serous otorrhea, there were no signs of mastoid involvement. In consultation with Dr. E. A. Crockett it was decided that in the light of the temperature the sister was then running and the absence of signs in the mastoid no apprehension need be felt.

The morning temperature became normal a week after the first visit and remained so for the next six days, the evening temperature staying at 99°. During this time the otorrhea lessened in amount becoming seropurulent in character, but as a slight drooping of the right posterior superior canal wall had developed Dr. Crockett was again called in consultation when it was decided that the patient was in no immediate need of operative interference. In addition to the low temperature, the decreasing otorrhea and absence of mastoid tenderness and edema, a bacteriological examination of both ears had shown staphylococcus aureus in pure culture.

As stated before, for six days the temperature did not go above 99°, then for the next five days it steadily increased

mounting higher and higher day by day, the patient meanwhile showing signs of severe sepsis. During this time the drooping in the right canal disappeared and no other signs of mastoid involvement appeared in either mastoid. The otorrhea instead of increasing appeared to be slowly diminishing so had it not been for the increasing temperature and accompanying sepsis, it would have been thought that the case was progressing favorably. On the fifth day after the commencement of septic symptoms Dr. Gerber by means of a portable apparatus took radiograms which when developed showed infection and breaking down of cell structure in both mastoids. Radiograms would have been taken sooner had it been thought possible to secure any definite information by means of a portable apparatus, for negative findings would only have increased the difficulties in this particular case.

The evening temperature this day reached 105°, but the following morning the temperature again dropped to normal and patient's condition appeared better than it had for several days. The parents naturally wished to postpone operation but with the positive evidence of the radiograms at hand were readily convinced of its necessity. A double mastoid operation was performed this same morning, the writer being assisted by his former chief, Dr. Crockett, a courtesy greatly appreciated. Both mastoids were found to be practically alike in both structure and pathologly, removal of an unusually thick dense cortex revealing large and extensive necrotic cells filled with pus and granulations. The left sinus was bare for about two-thirds of an inch. Cultures taken from both mastoids showed streptococcus in pure culture, presumably the mucosus capsulatus, although this point was not determined. Two previous examinations of the aural discharge had shown nothing but staphylococcus aureus. For four days following the operation patient appeared very septic, was delirious most of the time and ran a high pulse and temperature. When conditions seemed to be at their worst, the temperature suddenly dropped to normal and patient made an uninterrupted convalescence.

This case illustrates the difference between hospital and private practice for the rising temperature and accompanying sepsis were of themselves sufficient to justify exploration of both mastoids, a procedure of easy accomplishment in hospital practice where securing permission to operate is the least of our worries. In this case the father later assured the writer that he would not have consented to the operation in the absence of positive evidence of mastoid involvement, such as we had in the radiograms, in other words, he would not have consented to an "exploratory" operation.

Case 13. A double decked mastoid in which the lower deck of cells was discovered at the second secondary operation.

This history is reported from the records of the Massachusetts Charitable Eye and Ear Infirmary by courtesy of Drs. F. A. Washburn and G. L. Tobey, Jr., the patient having been last admitted during the interneship of the writer. The essentials of the hospital records are given but are somewhat rearranged for the sake of continuity.

Out-Patient Record No. 35685 a. Patient a male child aged 3.

1903, September 10. Diagnosis, Secondary Mastoditis. Recommended for admission to house.

House Record. Mastoid operation five months previously at the Carney Hospital.

September 19, secondary mastoid operation, old cavity cleaned out and opening into antrum enlarged, no sinus or dura exposed. Wound healed very slowly.

Out-Patient Record Continued.

November 23. Small amount of superficial granulations.

December 12. Wound healed but tissues very soft.

1910, August 8. Old mastoid wound has broken down again, slight discharge, no bare bone.

August 9. Recommended for admission to house.

House Record. Vol. 30, Page 32.

1910. August 12. Diagnosis: Unhealed Mastoid Cavity. Since the previous operation, September 19, 1903, the

mastoid cavity has frequently become moist, the last time about one week ago, no otorrhea.

Examination. Large depressed cavity in left mastoid with large granulating moist area at bottom in region of antrum. Small sinus evidently leading to middle ear at floor of cavity.

August 17. Operation, (Dr. G. L. Tobey, Jr.) Old cavity was curetted out. *A second deck of mastoid cells that had never been opened was found under the posterior canal wall* and thoroughly curetted out. Sinus was exposed and found in normal position. Dura over tegmen was also exposed. Antrum was opened very widely. Skin dissected up posteriorly and trimmed. Wound sutured above and below, wick to antrum. The case made a slow but uneventful recovery, the operation cavity showing but little tendency to granulate healed by dermatization.

It would be interesting to know the character of the cell structure found at the first operation. The child was then three years old, an age in which well marked pneumatic structure is unusual, although Stewart (14) has demonstrated by X-ray examination an extensive pneumatic development at the age of two. According to the writer's remembrance of the third operation, performed seven years after the second, the old operation cavity was large and extensive, suggesting the previous removal of considerable cell structure; the second deck of cells, separated from the cavity by a layer of dense bone, extended deeply into the posterior part of the pyramid. A stereo-radiogram of this mastoid would in all probability have disclosed the infected cells as in Case 7 (Fig. 19).

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Since the reading of this paper the writer has eliminated the word roentgen both as a prefix and as a descriptive adjective, using instead the English nomenclature.

THE METHOD OF ANALYSIS OF THE BARANY TESTS IN PATHOLOGIC CASES*.

By LEWIS FISHER, M. D., Philadelphia, Pa.

In order to be able to interpret the various findings obtained by an examination of the vestibular apparatus it is essential that the data be properly recorded. It is helpful to use a special chart, such as here shown, so that all the salient features of the examination may be reviewed at a glance.

The first problem in any given case is whether we are dealing with a functional or an organic condition. If the chart shows all responses to ear-stimulation perfectly normal, a functional condition may be suspected. When the responses obtained on stimulation are not normal, the case should be considered as having an organic lesion. Such a deviation from the normal need not include all the responses. An impairment of even one response shows that we are dealing with an organic lesion.

Having concluded that the case presents an actual involvement of some portion of the vestibular apparatus, our next problem is to determine whether the case is one of peripheral or central lesion. This is the most important and at the same time most difficult diagnosis that the otologist is called upon to make. Many cases of cerebellar lesions or tumors of the cerebello-pontile angle present symptoms similar to those observed in an affection of the labyrinth—the mis-called "Menieres' disease"; on the other hand labyrinthine lesions not infrequently simulate cerebellar affections. The findings obtained on ear-stimulation are frequently the deciding factor in the diagnosis, and it therefore behooves the otologist to exercise the greatest care in determining this point. It might not be amiss to emphasize a few of the most important principles of this differential diagnosis.

In a peripheral lesion *all* the responses are impaired, and conversely the presence of any one *normal* response to stimulation indicates a normal labyrinth and VIII Nerve. A

*Candidate's thesis of the American Laryngological, Rhinological and Otological Society. Recommended for publication by their Council.

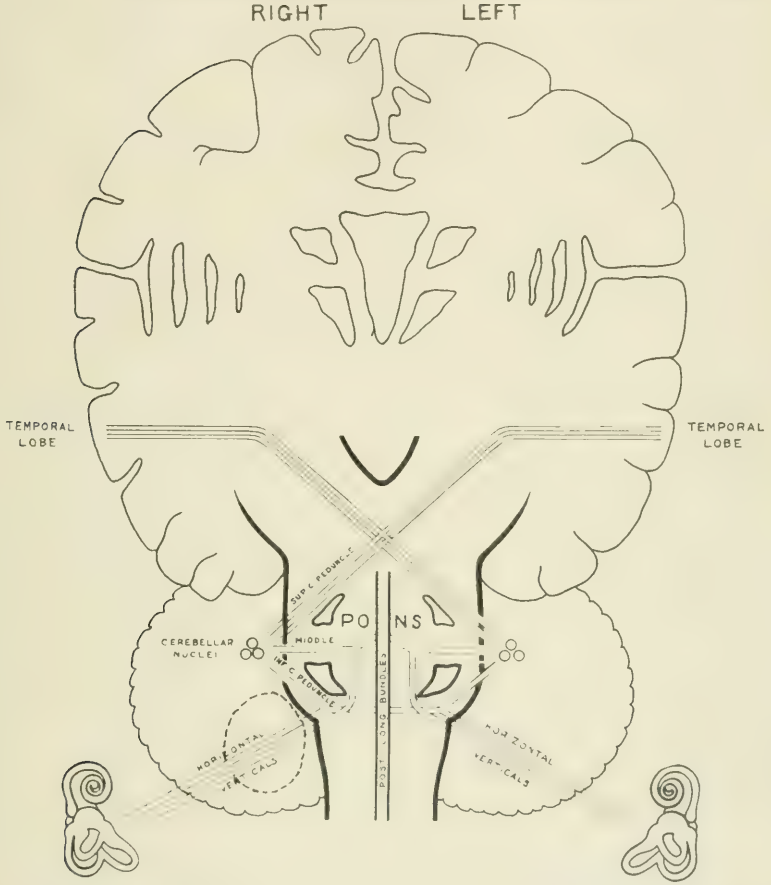
spontaneous nystagmus in the vertical plane either upward or downward indicates a central lesion. If stimulation produces a "perverted" nystagmus then again the lesion is central.

If the findings lead to the conclusion that the lesion is central, then our next problem is to attempt to locate the lesion more definitely within the cranium. The facility with which one is able to do this depends in a great measure upon how well he can visualize the various pathways constituting the vestibular apparatus. The simplest method of procedure is that of elimination. We begin with the labyrinth and proceed brainward considering each structure by itself. With good hearing and one or more responses on stimulation of the static portion of the labyrinth normal, the labyrinth itself and VIII Nerve are to be considered uninvolved. For information relative to the medulla oblongata and inferior cerebellar peduncles we examine the responses obtained on stimulation of each horizontal canal separately. This test is performed routinely by tilting the head back 60° after douching. If this produces normal horizontal nystagmus and vertigo with past-pointing, the medulla oblongata and inferior cerebellar peduncle of that side may be considered uninvolved. To determine the integrity of the pons, we examine the responses obtained from the vertical semicircular canals. These are tested when the ear is douched with the head 30° forward—the so-called upright position. If the chart shows a normal rotary nystagmus with vertigo, past-pointing and falling, it suggests uninvolved pathways in the pons and middle cerebellar peduncle of the side douched. The cerebellum is considered as not the seat of any gross lesion, if stimulation of either ear or any canal produces a past-pointing of both arms in both directions.

With the chart critically examined in this manner and all the possible points of involvement along the nerve tracts in mind, we attempt to find one location which would satisfactorily account for all of the impaired responses. Thus, when the tests of all the semicircular canals of both sides produce impaired or absent vertigo, instead of assuming a great many lesions, it is more reasonable to suppose that there is one lesion

at a point where all the fibres concerned in vestibular vertigo come together. Such a point is found at the decussation of the superior cerebellar peduncles where all of the fibres concerned pass from the cerebellum on their way to the cerebral cortex. Again—given a case with no responses at all from stimulation of the right ear, and an absence of responses from the vertical canals of the opposite or left ear. Instead of assuming two lesions—one located in the right labyrinth cutting off all the responses from that side, and another lesion in the left side of the pons, it is more reasonable to explain the whole "phenomenon—complex" by a single lesion in the right cerebello-pontile angle, where an involvement of the right VIII Nerve by a lesion would produce no responses on stimulating the right labyrinth, and the same lesion by pressure against the brain-stem would interfere with the responses from the vertical canals of the opposite side.

Just as in Neurology a certain group of symptoms occurring with a definite lesion are spoken of as the "symptom-complex" for that lesion—in the same way we have come to recognize a certain group of phenomena obtained on ear stimulation as the "phenomenon-complex" for that particular lesion. We must bear in mind the following:

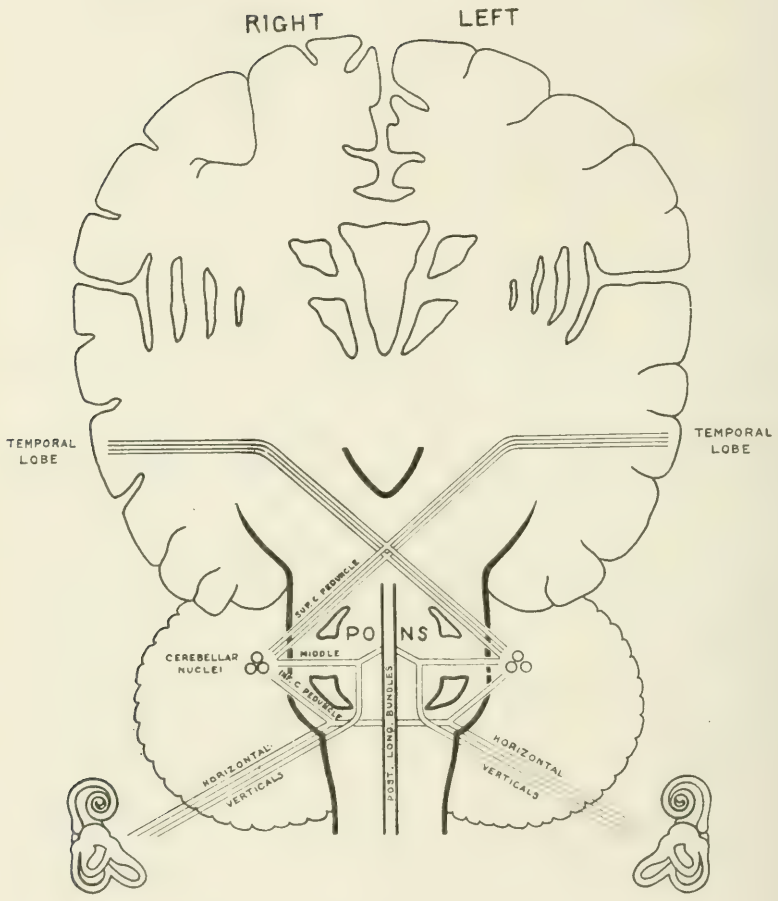


Through a photographic error the lesion in this case is represented by a circle around the left labyrinth instead of around the right where it should properly be placed.

1. If the results of stimulation of the right ear are:

   Nystagmus, none
   Vertigo, none
   Past-pointing, none
   Falling, none

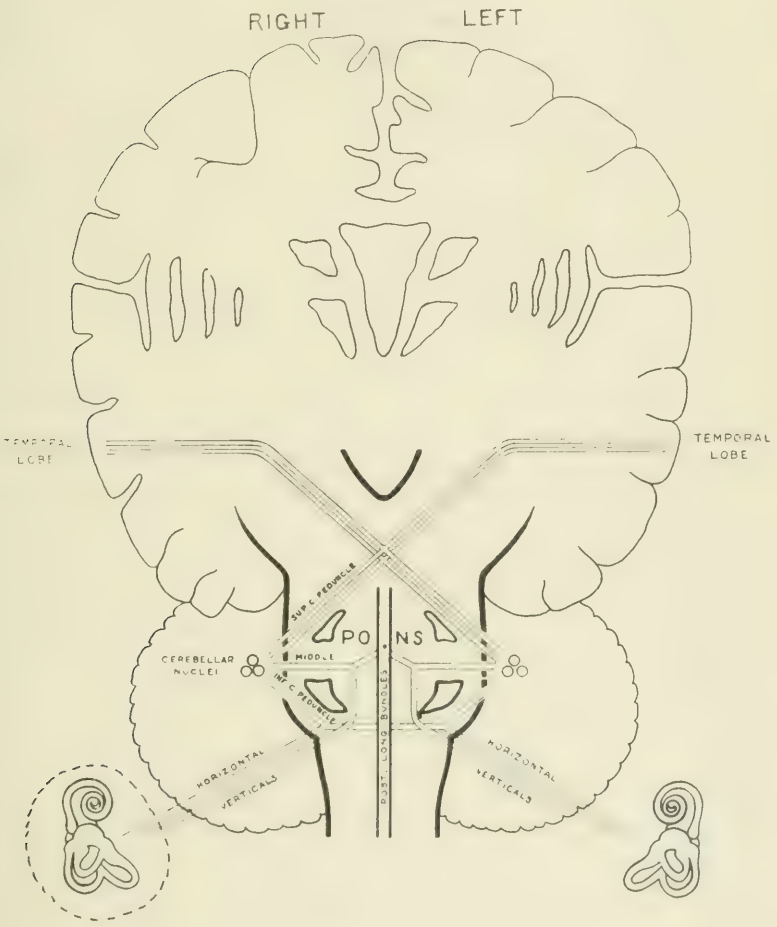
there is obviously a destruction of the labyrinth or VIII Nerve. We would of course have the corroborative evidence of complete deafness of this ear. This picture of a dead auditory apparatus and a failure of any of the semicircular canals to produce responses, shows beyond all doubt that the labyrinth or VIII Nerve is destroyed.



2. If stimulation of the right horizontal canal produces:

Nystagmus, none
Vertigo, normal
Past-pointing, normal

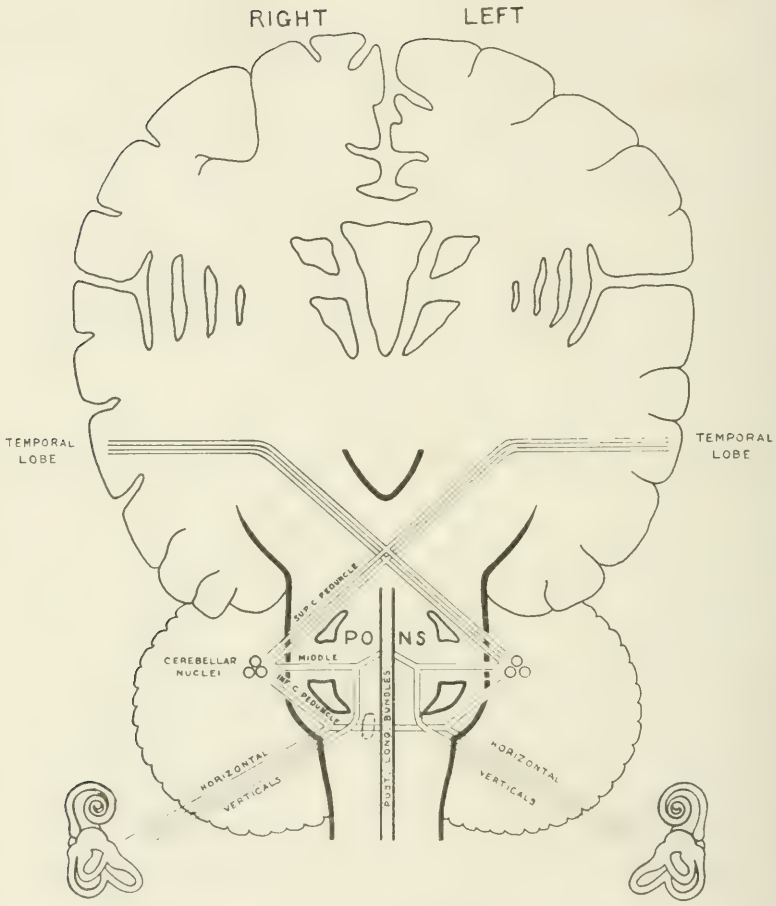
it suggests a lesion in the medulla oblongata between Deiters' Nucleus and the posterior longitudinal bundle on the right side.



3. If stimulation of the right horizontal canal produces:

Nystagmus, normal
Vertigo, none
Past-pointing, none
Falling, none

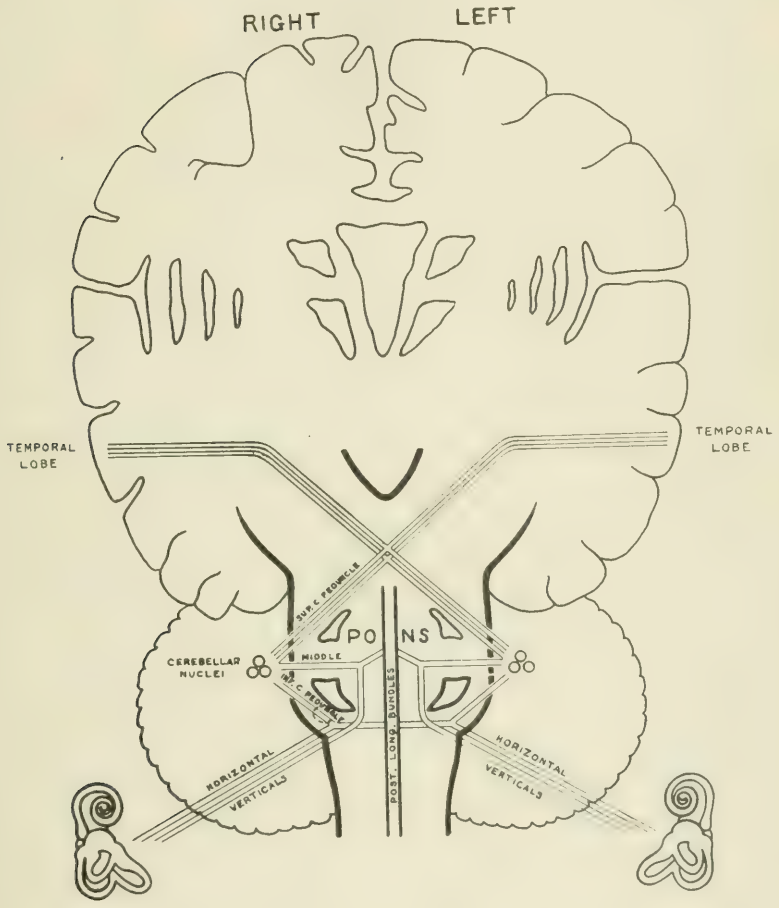
it suggests a lesion of the right inferior cerebellar peduncle.



4. If stimulation of the right vertical canals produces:

Nystagmus, none
Vertigo, normal
Past-pointing, normal
Falling, normal

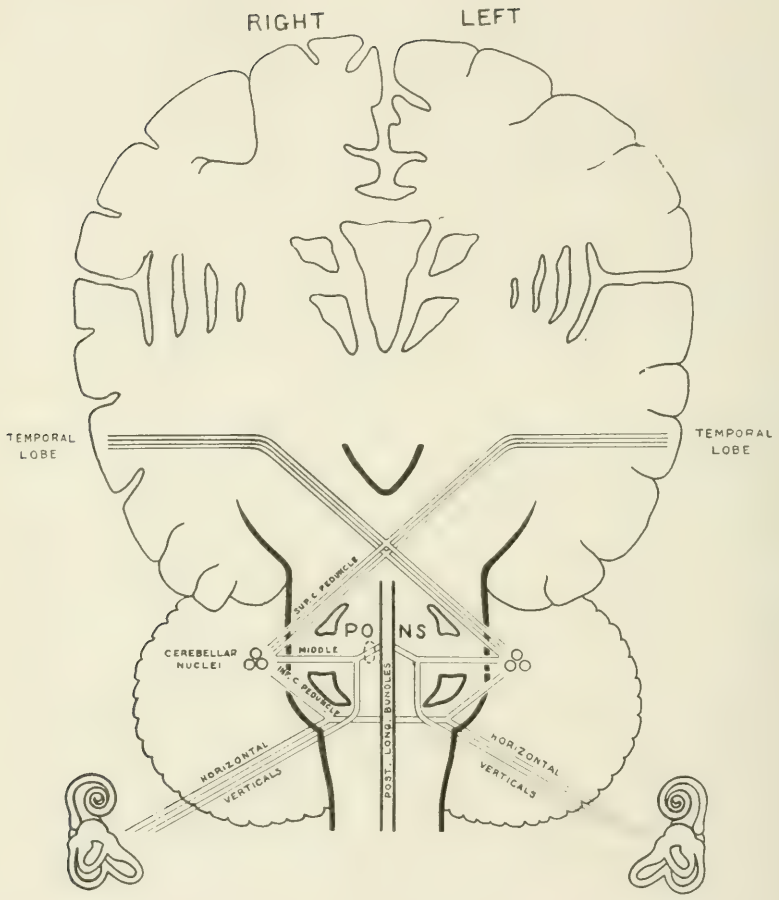
it suggests a lesion in the posterior portion of the pons near the posterior longitudinal bundle on the right side.



5. If stimulation of the right vertical canals produces:

Nystagmus, normal
Vertigo, none
Past-pointing, none
Falling, none

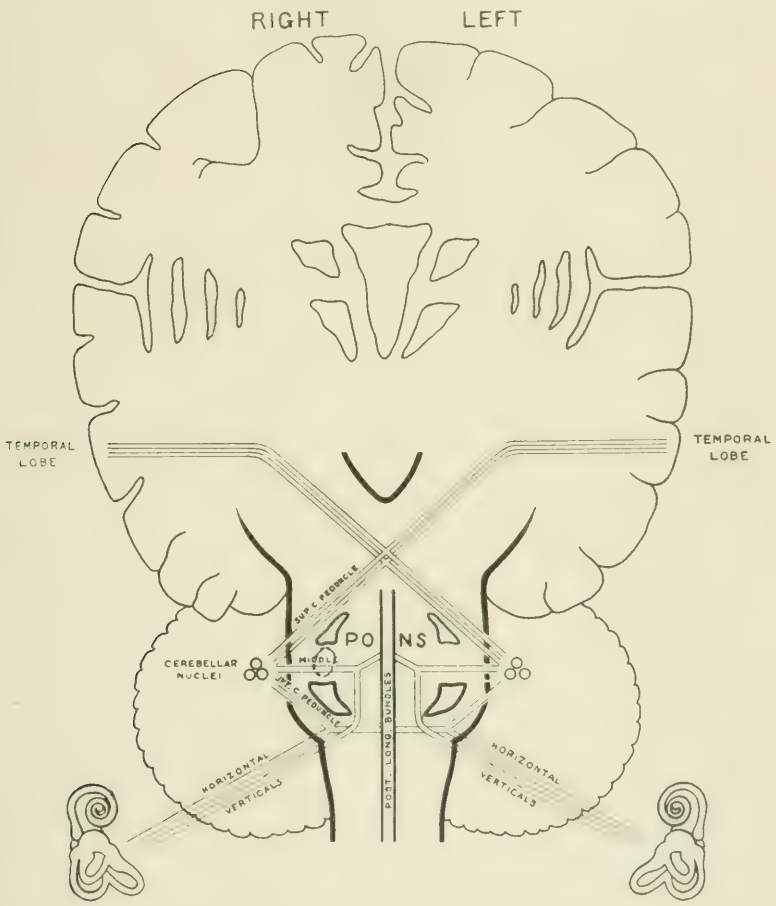
it suggests a lesion of the right middle cerebellar peduncle.



6. If stimulation of the horizontal canals of both ears and also of the vertical canals of both ears produces:

Nystagmus, none
Vertigo, normal
Past-pointing, normal
Falling, normal

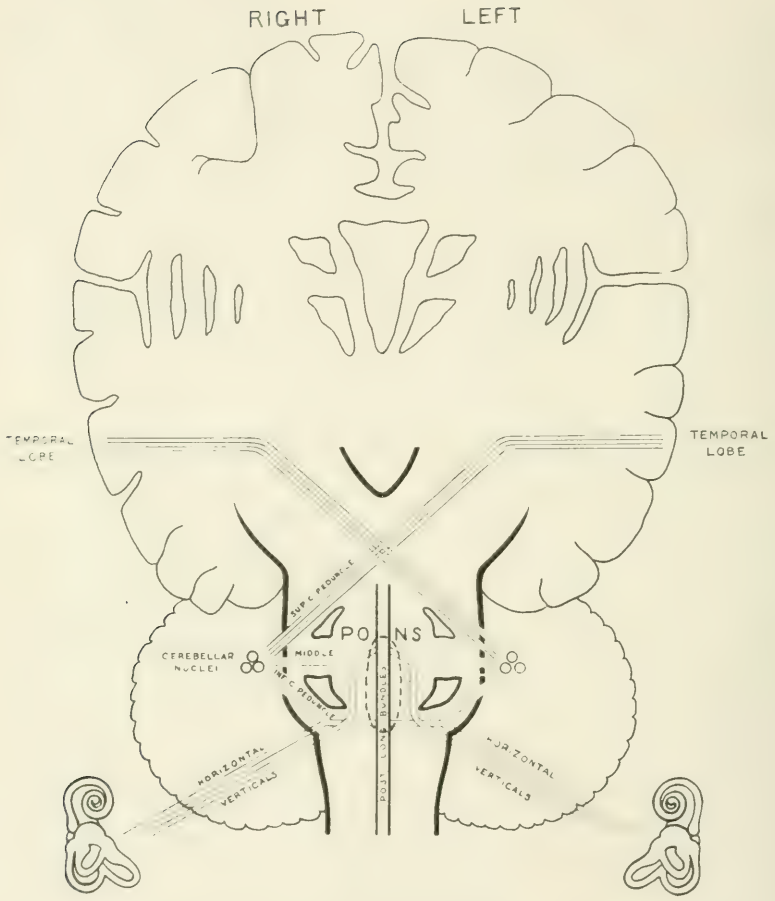
it suggests a lesion of the posterior longitudinal bundle itself.



7. If stimulation of the right horizontal canal and also of the right vertical canals produces:

Nystagmus, normal
Vertigo, none
Past-pointing, none
Falling, none

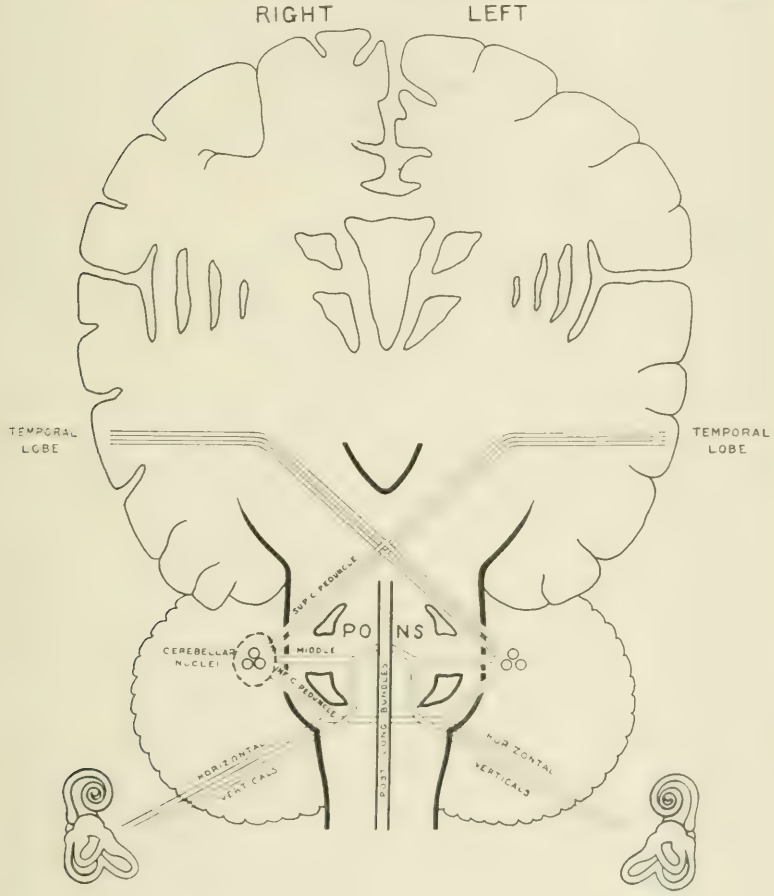
it suggests a lesion of the cerebellar vestibular nuclei of the right side.



8. If stimulation of all the semicircular canals of both ears produces:

Nystagmus, normal
Vertigo, none
Past-pointing, none
Falling, none

it suggests a lesion at the base of the cerebral crura at the point of decussation of the two superior cerebellar peduncles.

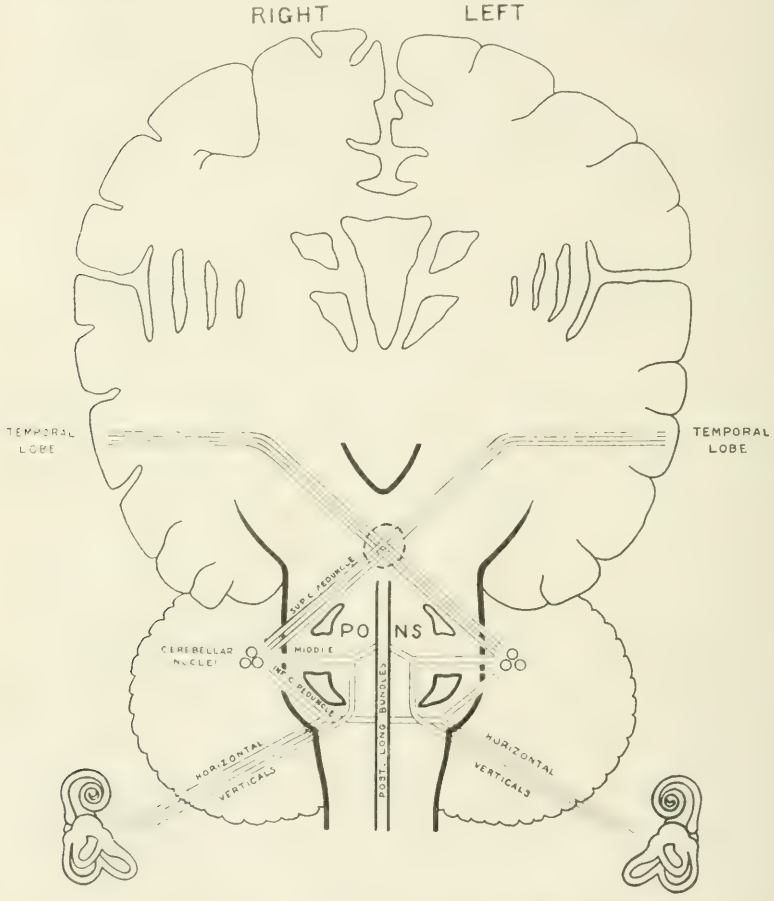


9. If there is a total deafness in the right ear and stimulation of the right horizontal semicircular canal and of the right and left vertical semicircular canals produces:

Nystagmus, none
Vertigo, none
Past-pointing, none
Falling, none

and stimulation of the *left* horizontal semicircular canal produces normal reactions, the lesion is located in the right cerebello-pontile angle.

Of course when confronted with actual pathologic cases of intracranial involvement the findings may be obscured by pressure phenomena, and it is not the purpose of this paper to indicate that a diagnosis of the exact location of the



lesion may be made in such a simple manner as indicated in the "phenomenon-complexes" presented. This method of analysis, however, constitutes a means of approach in explaining the significance of impaired or absent responses to stimulation of the vestibular portion of the internal ear.

TESTS OF THE VESTIBULAR APPARATUS

Nystagmus	Spontaneous	Pointing: Right Touched	Pointing: Left Touched
Looking to RIGHT very slight or none Looking to LEFT very slight or none Looking UP None Looking DOWN None	Shoulder from above Nystagmus None Vertigo None Past pointing None Falling None Romberg Negative Turning head to right Negative Turning head to left Negative Attempt to overthrow Normal Pelvic movements		
	Turning		
To RIGHT ->—> Amp. Good Duration 24 Sec.	To RIGHT Shoulder from above Nystagmus Normal Vertigo Normal Past pointing Normal	12″ to Right	10″ to Right
To LEFT <— Amp. Good Duration 24 Sec.	To LEFT Shoulder from above Nystagmus None Vertigo Normal Past pointing Normal	10″ to Left	12″ to Left
	Caloric		
Douche RIGHT ↻ Amp. Good After 40 sec.	Douche RIGHT Shoulder from above Nystagmus Normal Vertigo Normal Past-pointing Normal Falling Normal	8″ to Right	6″ to Right
Head Back. -> Amp. Good		10″ to Right	8″ to Right
Douche LEFT ↺ Amp. Good After 40 sec.	Douche LEFT Shoulder from above Nystagmus Vertigo Past pointing Falling	6″ to Left	8″ to Left
Head Back <— Amp. Good		8″ to Left	10″ to Left

Name Age Date

Address

Referred by

DIAGNOSIS: Normal

SUMMARY: Normal reactions, suggest normal
1. Labyrinths
2. VIII Nerves
2. Medulla Oblongata
4. Pons
5. Cerebellar peduncles
6. Cerebellum

Complains of nothing

HISTORY:
Dizziness, none
Staggering, none
Deafness, none
Tinnitus, none

NOSE: Normal
THROAT: Normal
A. D. Normal

EARS:
A. S. Normal
Fistula. Negative
Hearing Tests

A =	3	A	S	AC >	BC = N	Pol.	+	C	Good	Galt	.7	+
	3		S	AC >	BC = N		+		Good		Weber .7	−

Discussion.

Dr. George F. Cott, Buffalo, N. Y., said the otologist would encounter in future a great many toxic, neuritic and hysterical cases in which one response would be elicited and then, after waiting five or six days, there would be no response from the healthy side and a response from the other. This was an important point. The technic of the examination was another important point. He cited an illustrative case, in which the patient, a woman, would be dizzy and would past-point to the left every time a test was made. Finally she was examined by Dr. Fisher and found to be absolutely normal. On account of the necessary technic the test would not be popular except with those who appreciated its vast importance.

Dr. E. M. Holmes, Boston, Mass., emphasized the point that brain tissue is compressible, and the last part pressed upon gives, at least temporarily, the more marked symptoms. Any examination, however accurate and critical, would give wrong impressions unless repeated a number of times. These cases varied from day to day. At autopsy it was amazing to find the extent of the lesion in the cerebellum or at the cerebellar pontine angle, where the symptoms pointed to a lesion at the pons or cerebellum, and where the tests were misleading. It should be borne in mind that the most perfect findings, applied theoretically, would be misleading in these cases.

Dr. Fisher, closing the discussion, said that his work represented conclusions drawn from examinations of hundreds of pathological cases, many of which had been verified by operations or autopsy. The scheme of pathways and method of diagnosis of location of the lesions as shown had practically left the domain of theoretical and had become eminently practical. He was not surprised that the findings in regard to nystagmus and vertigo often did not go together. The demonstration of that point was the object of his work. These represented two separate afferent

impulses traveling along two distinct pathways. Under pathological circumstances something might occur which would leave one system of pathways intact and impair the other. Vertigo, being a subjective response, could not always be relied upon. Fair conclusions, however, could be drawn as to the condition of the cochlea from examination with tuning-forks, in spite of the fact that those are based entirely on subjective responses. In a similar manner the experienced examiner of vestibular cases is able to differentiate vertigo responses that could be depended upon from those that could not.

SPONTANEOUS RECOVERY FROM LATERAL SINUS THROMBOSIS. A CASE WITH VERY UNUSUAL FEATURES.

By RICHMOND McKINNEY, M. D., Memphis, Tenn.

Although recovery from lateral sinus thrombosis without operative treatment is regarded as a possibility, and may occur more frequently than we realize, our experience has taught us that unless the clot is turned out, with the establishment of free circulation through the jugular vein, practically all these cases go to certain and usually speedy death, or if they do weather the immediate symptoms of sinus thrombosis, there will be a later complication, such as a pulmonary abscess, which will bring about a fatal termination. It is these facts, taught us through accumulated experience and observation, and also the further definite knowledge that timely operation results in the saving of at least fifty per cent. of these cases, which cause us to urge prompt operative intervention in this condition.

It has occurred to me that the case which I am about to describe in detail has so many unusual features that it may be interesting, and for this reason I am reporting it on the present occasion.

On September 4th, 1917, I was consulted by John B. S., of Memphis, aged eleven years. He said that his right ear had been aching for two days. He attributed this to getting water in his ear while swimming. For two months, however, this ear had been discharging, off and on, and several weeks previously, while in a summer camp in the north, he had been in the camp hospital for ten days, suffering with the same ear. The night before he consulted me, he had had a great deal of pain in the ear, and it had been irrigated with warm water, without relief. This morning it was quite painful.

Examination of the ear showed a very small quantity of pus in the canal, with a median perforation of the mem-

brana. His temperature at ten A. M. was 100 F. On deep pressure slight pain was complained of in the mastoid tip. The boy was sent home, with instruction to have the ear occasionally irrigated with warm boracic acid solution, and to use the customary icebag to the ear. That evening his father reported him as doing nicely, and said it was not necessary for me to see him. The next morning it was reported to me that the boy had had a comparatively comfortable night, but in the evening, since he had had some fever during the day, I saw him at his residence, but saw no reason to make any change in the treatment then being used. The evening of the next day the boy's father reported to me that the little fellow had had no fever all day, and was feeling fine. The next morning I was 'phoned that the temperature had gone higher than 104 F that morning. He was seen at this time by the family physician, Dr. E. D. Mitchell, who reported to me later that he had found pus in the canal of the affected ear. The temperature was brought down with phenacetine and sponging. A blood examination was reported negative as to malarial parasites, but there was a polynuclear percentage of 92. No leukocyte count was made. In the evening, the temperature still running high, going to 105°, consultation was held with Dr. P. M. Farrington. At this time I enlarged the opening in the membrana tympani by a free incision, but no pus was seen in the canal prior to this, nor after the incision was made. There was slight, if any, mastoid tenderness. At two o'clock on the morning of the 8th, the temperature was 105 F, plus, but went down steadily, without antipyretic measures, to 102 1/5 F at ten o'clock in the morning. From that time on it began to rise, until at three o'clock it was 104 F. There were no rigors, sweats or other indications of intracranial involvement, and all reflexes were normal, but after another consultation, it was decided that the mastoid should be opened. At four o'clock a simple mastoid operation was done. As was to be expected in a mastoid which had been subjected to more or less constant inflammatory attacks, the bone overlying the antrum was eburnated, with no pus, until

the antrum was entered, and then only a very small quantity of pus, and some granulations. The antrum was completely exenterated, leaving a perfectly smooth cavity, with no sinuses apparent in any direction. The temperature at the time of operation was 105 F., pulse 128. At six fifteen P. M., about an hour after the operation, the axilliary temperature was 102.8 F., pulse 140. A Murphy drip of 5% soda solution had been begun immediately on bringing the patient from the operating room, but this was discontinued at six o'clock, since he was unable to retain it. The temperature steadily dropped, until at eight-thirty P. M., following a profuse sweating, the temperature had gone down to 98.8 F., by the mouth, with pulse 120. At two in the morning the temperature was subnormal, and a short while afterward it began to go up again, until at eight-twenty that morning it was 105⅕ F., pulse 120. The temperature was reduced from time to time with ice-water sponging. The temperature fluctuated, with the patient sleeping a great deal. The afternoon of the day subsequent to the operation, he complained of pain in the right shoulder, the temperature going up in the afternoon to as high as 104 3/5 F. The child could not stand to be sponged, and was chilly and shaking, besides being quite somnolent. An icebag had been kept to his head constantly, and routine treatment, such as phenacetine occasionally, and small doses of quinine, had been given. The temperature continued to run up and down, being reduced largely through sponging. On the morning of the 10th, two days after operation, I dressed the mastoid wound, and found it perfectly clean, with no pus. At this time the little fellow was complaining of a painful spot at the end of the spine, where a small red swelling was noticed, and it was anticipated that an abscess was forming there. A graphic temperature chart was begun on this day.

It is unnecessary to recapitulate the temperature variations in this case in the body of this report, since the accompanying graphic temperature chart shows these, so I shall confine my report to the essential details and noteworthy features of the clinical course.

A blood count, made September 12th, four days after the operation, showed 6200 leukocytes, with a polynuclear percentage of 84. This indicated the low resistance of the patient. On the 14th there were 9600 leukocytes with 63 per cent. polynuclears. The tenderness beneath the right scapula had on the morning of the 15th developed a swollen area, and the attending physician, Dr. Mitchell, thought it contained pus, and under light ether anesthesia this was opened, and about a teaspoonful of yellow pus removed from beneath the border of the scapula. This pus was of the ordinary staphylococcic variety. Urotropin, five grains three times daily, was ordered. On the afternoon of the 17th inst., the place at the end of the spine, where pain had been complained of, had developed a swelling, and under local anesthesia this was opened by Dr. Mitchell, a dram or so of pus, similar in character to that of the previously described abscess, being removed. The child complained at intervals of chilly sensations, and as will be noted from the accompanying graphic chart, these chilly sensations came on at the time the temperature started down, and there then came an immediate temperature reaction, this shooting up to between 104 and 5 F. This characterized the patient's condition almost from the beginning of my attendance upon him, and as will be noted, the rigors and temperature course were typical of a sinus thrombosis, with occasional detachment of clots into the circulation. The abscesses too were evidently metastatic and confirmed the strong suspicion that this was a case of sinus thrombosis. Evidence of any other kind, however, was lacking. The eye grounds were perfectly normal. There was no jugular rigidity or tenderness, and the boy apparently was in good condition, other than a rather pronounced degree of emaciation.

A blood culture was negative as to bacteria of any kind, and the leukocyte count, as has been mentioned, was not especially high, while the polynuclear percentage was nearly normal at the last count.

Further consultation was had on the afternoon of September 20th, and it was decided to reopen the mastoid

wound, and to explore the lateral sinus. The boy was taken to the hospital immediately, and on opening the wound, we found just what was to be expected in a healing mastoid wound, there being only a few drops of pus, the cavity being filled with granulations. The very dense bone was then carefully removed back to and around the sinus, exposing it to the knee. The sinus wall was greatly thickened and grayish, but a slight pulsation was noticeable. It was then determined to wait a few hours before opening the sinus, and the boy was returned to his room, and given stimulation for his, at this time, rather weakened circulation. Immediately following the operation, as will be seen from the temperature chart, the temperature dropped to subnormal, gradually going up, and again down and up, but ran an almost flat course from that time on, and the little fellow made an uneventful recovery, with no complications of any kind, and in the second campaign for the sale of Liberty bonds, distinguished himself by disposing of a half million dollars worth of these.

I submit this case report on account of its to me very interesting features. I am convinced that there was a lateral sinus thrombosis, located above the knee of the sinus, but not entirely occluding the sinus, and I believe that this infection took place through venous channels, as the most careful investigation failed to disclose any involvement of the bone anywhere near the sinus wall, and, as I have said, this bone was very dense in character. The question that occurs to me is, what bearing removal of the overlying bone had upon this recovery by, I may say, crisis, and was this merely coincidental? No doubt surgical removal of the source of infection was the cause of the child's ultimate recovery, but the change came so quickly after the second operation that I wonder what influence this had upon it. However, we are confronted by the positive evidence, as shown by the history and temperature record, that sepsis existed in all of its activities at the time of the second operation, and then, when this was performed, almost as though touched by a magic wand,

we had a spontaneous change, and prompt recovery of the patient.

Discussion.

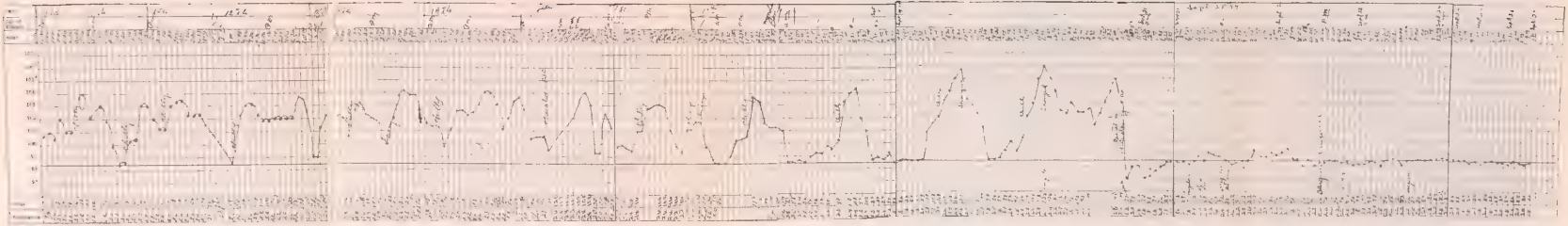
Dr. Wendell C. Phillips, New York City, said his attention had been called to spontaneous recovery of lateral sinus thrombosis during a long period of teaching operative surgery of the mastoid operation on the cadaver. During this time he had repeatedly discovered obliterated lateral sinuses, even in cases that had died from other diseases. But there was invariably evidence of purulent disease of the middle ear. From this he had become convinced that there was a certain proportion of cases in which spontaneous recovery from lateral sinus thrombosis took place, and that in every case the sinus was obliterated. His clinical experience had also borne this out and had convinced him that many cases of lateral sinus thrombosis, especially of typical types, recovered spontaneously.

The friendly criticism was offered that this Society should not give its approval of the use of the icebag in mastoiditis.

Dr. George F. Cott, Buffalo, N. Y., said many cases of lateral sinus thrombosis following suppuration of the middle ear did not come to operation because of spontaneous recovery. Many of the younger members of the profession were apt to operate whenever they found these typical symptoms after more experience they were not so anxious to operate. No matter how much the temperature varied the patient was not necessarily septic; they generally felt pretty well, slept well and had good appetite.

Dr. E. M. Holmes, Boston, Mass., had had better results in ligating the sinus and then using the curet. Secondary bleeding was rare after thorough removal of the clot.

Dr. Eagleton added that, from his own experience, he could state that the sinus could be ligated in any portion in three minutes. One could ligate above and below and obliterate the entire sinus.



Dr. McKinney, in closing the discussion, said he was glad to have had such a free discussion of his paper, but that the range of the discussion had not at all been confined to the subject presented by him. Indeed he was rather reminded, by the trend of this discussion, of a conversation that occurred between two negro men who met in a country road. One of the negroes inquired of the other: "Say, nigger, whar is you gwine?" The other replied: "I'se gwine whar I'se gwine, dats whar I'se gwine." So it was with this discussion, which ranged from the operative treatment of lateral sinus thrombosis to the question of the possibility of spontaneous recovery from lateral sinus thrombosis.

To Dr. Phillips' criticism of the use of the icebag, he would say that he was under the impression that most text-books on otology mentioned this as a part of the routine treatment for mastoiditis, and even thought this was mentioned in Dr. Phillips' own book, but of course probably was mistaken. However, doubtless nineteen out of twenty otologists still use an icebag, to a certain extent, as this for a long time had been routine treatment. Personally he had found neither advantage nor disadvantage from the use of the icebag, and did not advocate it as a routine measure, and in the case described had really advised it more on account of the high temperature the boy was running, seeking the effect of ice in reducing high fever.

With regard to Dr. Cott's statement that this was not septic fever, he felt that if this was not, his teaching as to what constitutes sepsis had been erroneous. Certainly most of us have always thought that a normal or subnormal temperature, with a steady rise to 104° or 105°, or higher, in the afternoon, then a rigor, with a sharp decline to normal or subnormal, was typical of sepsis, and he was afraid that if this was not true, all teachers and text-books had been imparting faulty teaching. He wished to express his appreciation of the very generous and general discussion of his paper.

The chairman said that Dr. Cott would be given an opportunity to explain what he understood by septic fever.

Dr. Cott, replying to Dr. McKinney's request, reiterated the explanation he had given before the American Laryngological, Rhinological and Otological Society last year. The temperature, he claimed, was not due to sepsis, but to action of a proteolytic enzyme which digested the embolus or fragment of an embolus, with an accompanying heat.

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